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Editorial.

DR. CARNEGIE'S GIFT TO SCOTTISH UNIVERSITIES.

IT will be well that the Veterinary Profession should know exactly how Dr. Carnegie's gift will affect the Veterinary Colleges, and we purpose showing it. At some of the Universities in Scotland there is a degree known as the Bachelor of Science in Agriculture, and one of the subjects in which the candidate is examined is called Veterinary Hygiene.

Now the University of Edinburgh (like the other Scottish Universities) has no professor or lecturer in the University on that subject, and so it graciously recognises *each* of the Veterinary Colleges in Great Britain and Ireland as an extramural school for the teaching of Veterinary Hygiene.

The term Veterinary Hygiene is a vague one, and may mean much or little. For example, if any one chooses to consider that a full course of veterinary education of four years is necessary for a thorough acquaintance with Veterinary Hygiene, who can say him nay? If, on the other hand, any one chooses to consider that a course of fifty lectures in Hygiene in a Veterinary College is sufficient to give him the requisite knowledge of Veterinary Hygiene for his purpose, who can object? It is certain the Carnegie Trustees will not. They are prepared to pay the necessary fees at a Veterinary College in either case if the student fulfils certain conditions,—these being a minimum age of sixteen years, Scottish birth or descent, or two years' training at a recognised Scottish school after the age of fourteen, and the certificate of having passed the *University Preliminary Examination in Science.*

This last condition shatters all hope that the youth whose ambition is *only* to be a veterinary surgeon, and with no higher ambition, will take the trouble to prepare for this stiff examination. The University *Science* Preliminary Examination is much more difficult than the University *Medical* Preliminary Examination, which is more difficult than the College of Surgeons Preliminary Examination, which again is more difficult than the present Veterinary Preliminary Examination. Who, then, is going to pass this extremely (from a veterinary student's point of view) difficult pre-

liminary examination merely in order to obtain the benefits of Dr. Carnegie's gift? It would seem to be like burning a barn to boil an egg. As a matter of economics, it cannot be entertained for a moment.

Of course there will always be a few aspirants for the B.Sc. in Agriculture who will take a fifty-lecture course at a Veterinary College, and these men, if they so desire, may obtain the payment of the three or four guineas of fees, &c.; but they will not be veterinary students, and will have no intention of taking a full veterinary course of four years, seeing that a fifty-lecture course will qualify them for their examination in Veterinary Hygiene at the University.

We cannot help regretting, and we do not hesitate to express, our regret that Dr. Carnegie and his advisers did not see their way to accept a lower standard of entrance examination than the Science and Arts Examination. Had they chosen even the Medical Preliminary they would have fixed a high enough standard. We have all along been of opinion that it is unfair to ask students of science, medical or otherwise, to pass as severe a test in literary matters as those students whose career is to be more or less a literary one. What would the Professors of Greek and Latin and Mathematics say if the tables were turned, and a new Governing Board decreed that all budding divines and schoolmasters, lawyers, journalists, civil servants, and others who attend their classes were in future to show that they possessed a rudimentary knowledge of botany, chemistry, and natural history—all important and interesting subjects? Yet this would be quite as reasonable as to require of young doctors and veterinary surgeons a knowledge of the minute details of Latin or French grammar.

Perhaps a man like "Delenda est Carthago," of present day fame (?) in veterinary circles, who not only is a veterinary surgeon but a man of great literary attainments—a man who quotes Persian, Hebrew, Latin, and French with ease and freedom, and a man of perfect taste in matters of controversy—perhaps we ought to say an aspirant to the succession of "Delenda," might go through the work, but we hear that such marvels will occur only once in each long while.

Jesting apart, there may be a man of great ability and ambition with an intention of some day being a Minister of Agriculture, and able to say, and say truly, that he knows all about the diseases of the lower animals—such a man may take the full four years' course in Veterinary Hygiene before presenting himself for examination at the University—but it is useless to legislate for such exceptional cases. The men of genius or of great natural force can look after themselves; we must look after the average men.

We do hope that the Carnegie Trustees will recognise our claims to a share of their funds for equipment purposes. In the pathological laboratory, the physiological class-room, the natural history museum, and the dissecting-rooom equipment is half the

battle. Young men's eyes must be trained as well as their memories, they must learn not only what to do but how to do it. A professor of a literary subject requires only his books and papers; a professor of a scientific subject is useless without his apparatus—that is, his equipment.

ON THE POWER OF HUMAN STUPIDITY.

"THERE is in human stupidity," says Carlyle, "an opulence of murky obscurity, an inexhaustibility, a calm infinitude, against which the gods themselves are powerless, which seems to say, 'Hurl down your lightnings, and see if my big black belly is not able to contain them all.'" We are forcibly reminded of this stirring passage from one of the masterpieces of our great thinker when we read the amazing words uttered by one of the town-councillors of Glasgow at a meeting there, which our readers will find printed on another page of the JOURNAL. This gentleman ought to have been born in Spain some three hundred and fifty years ago, when the second Philip ruled the destinies of that unhappy country. The King would certainly have appointed him a member of the Inquisition, and might have made him president. He has a short and easy method of dealing with troublesome and uncomfortable people, amongst whom he would include all persons of a scientific turn of mind, and all who are not satisfied with the *status quo*. Such persons he would have sent, without delay and without compunction, to the torture chamber until they recanted their vile heresies. He would have looked on without wincing whilst Galileo was on the rack. "The impudence of the creature," we fancy we hear him saying, "to tell us that the earth is round when we all know it is flat; away with such pestilent fellows, who disturb our sleep at night and our joy by day!" As our readers know, a thoughtful Spaniard practically discovered the circulation of the blood long before Harvey's time, but they burnt him. So probably Mr. Scott would do with all medical men and veterinary surgeons if the Lord Provost would let him. He is really a wonderful person, and would be a perfect god-send to the western city if one could only take him at his word. Michael Scott and Merlin and Dr. Faustus pale into insignificance before Councillor Scott. Listen to this: "When Dr. Chalmers rushed into the Health Committee and launched his bubonic plague, everybody seemed to swallow what the Medical Officer said. I happened to have the courage to oppose the proposition of the plague being among us, and it vanished into thin air." What a fortunate city Glasgow is, having this beneficent magician in her Town-Council. A plague appears, the distracted and panic-stricken Dr. Chalmers rushes head foremost, not into the Clyde, as one might expect of a man in such a condition, but into a committee, with what

disastrous results to the poor committee we are not told, but doubtless the collision was terrific; then Dr. Chalmers, as was perhaps natural in a citizen of a great shipbuilding city, launches the Bubonic Plague (s.s.); things threaten to become serious, as everybody's mouth is agape with consternation, no one knowing what is going to happen next, when up jumps Councillor Scott, waves his magic wand, and heigh, presto! bubonic plague vanishes into thin air. Not even Prospero could do the thing more gracefully and effectively in his enchanted island. We have some dim recollections of reading in the *Glasgow Herald* in the course of the year that numerous cases of bubonic plague were treated in Glasgow, and that a special hospital was set apart for the treatment of the sufferers, and a special staff of doctors and nurses appointed for the purpose; but of course the editor of the *Herald* is a wicked man, and was doubtless trying to deceive us or cajole us into buying his worthless paper by telling us blood-curdling lies about the people in the west,—so much worse off than the inhabitants of Edinburgh. Or perhaps our memory is deceiving us; anyhow, we have Michael—we mean Councillor—Scott's word for it that the plague did not exist.

A friend looking over our shoulder as we write persists in saying that there was an outbreak of plague in Glasgow so late as the month of November, and that a great Railway Company was compelled to shut up its hotel on that account. (Well, between ourselves, courteous reader, and in strict confidence, we would say that this friend is a very decent fellow, and is generally correct in his statements, but, this being Christmas time and the season of festivity and pantomimes, we fear he is taking a liberty with us, and is trying to act the part of the hobgoblin which he saw at the theatre last night—or, to use Councillor Scott's word, the "bogey"—and so frighten us out of our wits. Perhaps the poor fellow is not quite sober, and this story of the hotel is a vision of his disordered imagination; it must be that, because Councillor Scott says there was no plague.)

The next heretic who engages the attention of this new Torquemada—plus Dr. Faustus—is the wretched bacteriologist of the commercial capital. He certainly does not commit the enormity of running full-tilt into a committee or launching a plague, but he wickedly asks for an assistant. Such sinful extravagance! But again Councillor Scott comes to the rescue and opposes the appointment. We do not quite gather whether in this case he was successful or not; he did not use his magic wand, but only his common sense, and the issue was therefore doubtful.

The full terrors of the Inquisition, however, are reserved for our colleague, the veterinary inspector of meat. That worthy person may perhaps have been at the Christmas pantomine also, and may have carried away exaggerated notions of the reality of "bogeys." At any rate he fancied he discovered a genuine one of diabolical

power and significance, which, he declared, bore the awful name of *Trichina spiralis.* This name is enough in itself to make the western blood run cold, and doubtless all Glasgow would have been plunged into mourning at the very thought of its spectral visitor, had it not been for its valiant champion, Councillor Scott, who had only to appear in his shining armour in order to banish the spectre for ever.

There is, however, a serious side to all this bluster, and we propose to direct our readers' attention to it, in order that the evil may be attacked at its beginning. In the first place, there is an intolerable vanity in the assumption of superior wisdom on the part of the speaker—a vanity that borders on insolence. What he calls a wish that lay members would use their commen sense is, as usual in such cases, little more than an appeal to vulgar self-satisfaction and contented obscurity. This of course is directly hostile to the scientific spirit and indeed to everything in the shape of progress and reform ; it is, we may take it, empiricism in its worst and most destructive form, and is a deadly insult to our profession. Without claiming any monopoly of wisdom or prudence for scientific men, we yet claim that science, properly so called, is the perfection of common sense. The scientific man is trained from the very start of his career to investigate the facts of existence from the standpoint of absolute truth and the most rigid logic ; everything in the way of tradition is subjected to the most severe test, and if it cannot endure this it must go overboard, or such part of it, at least, as is proved to be effete or decaying. The eternal verities are to the scientific investigator more sacred than to the ignorant and to the indolent man, just because he has proved them to be verities and eternal. But whatever is mere incrustation or the deposit of credulity and sloth, whatever is prejudice, caprice, or intolerance, is to the scientific man, as to the scholar, abhorrent, and he must resist it to the death. On the other hand, to the plebeian intellect, everything that demands thought and study is distasteful ; the intellectual Philistine likes to pose as the upholder of old—however rotten—institutions ; he fancies that whatever is ancient is necessarily venerable, and merely because it is ancient, forgetting the great law of nature as set forth by St. Paul, "that which thou sowest is not quickened except it die." His horizon is limited, but he keeps on clamouring that there is nothing beyond that horizon, frightened by dire imaginings of things that cannot be apprehended by his dull eyes. The appeal of such a man to his fellows, being an appeal to the natural indolence of mankind, is often a strong appeal, and often succeeds in retarding progress enormously, even when it is purely negative, but it is not always quite so respectable. We do not wish to impute ignoble motives, but we are not quite sure that the motives of Mr. Scott are quite unselfish ; we are not quite sure that he has not a sinister aim in view ; and we wish to point out possible dangers not only to our professional brethren,

whose character as scientific men he has so wantonly attacked, but to the public who may be misled by the astounding bravado of the man.

Trichinosis, as we veterinarians all know, is a very dangerous and subtle disease, and is no recent discovery. The older men amongst us will remember the scare that ran through Europe some thirty-five years ago when German physicans published the results of their investigations. They reported an enormous number of cases in which patients were suffering from the disease. The trichina had gained entrance into the human system more readily in some parts of the Continent than here, owing to the unfortunate custom of eating the flesh of swine in an uncooked or imperfectly cooked condition. This pestilent parasite, we would remind our readers, becomes encysted in the muscles of the pig, and would remain there for ever if the animal were allowed to die a natural death; but when the pig is slaughtered for market, and its flesh is used for human food, the trichina returns to its former activity, produces young, and these bore their way through the intestines of their victim, and finally settle down and become encysted in the human muscles. It has been discovered that the trichina cannot survive heat at which water boils, so that a ham, for instance, of a diseased pig which has been subjected *throughout* to a heat of 212° Fahrenheit (100° Centigrade) is rendered innocuous so far as the trichina is concerned; but, of course, every one will see that the guarantee of such care in cooking is a very slender one, even in England, and that the risk of infection far outweighs it. The disease has been very common in America, which supplies us with so large a proportion of our pork and bacon; and although every effort has been made by our transatlantic cousins to stamp it out, these efforts have not been successful. Veterinary surgeons, who are meat inspectors, know all this; they have been trained from their youth in the study of pathological conditions in the lower animals, and naturally know more of their habits and peculiarities than the average Medical Officer of Health; they ought, therefore, to be regarded as valuable adjuncts to the health department of any great city, and their opinion ought to be invited on all questions of meat supply. The position in Glasgow is quite a *reductio ad absurdum* of the whole matter. Mr. Scott tells us that the Medical Officer—and he talks as if "medical officer" were synonymous with "medical profession"—has never heard of trichinosis among the population of Glasgow; perhaps he has never found a case, but we are not informed whether he knows or does not know that there is such a disease—a very different question—or has heard of cases from his professional brethren. Mr. Scott, however, argues thus: Dr. Chalmers has not met a case of trichinosis, or perhaps has never heard of a case, or perhaps has never heard that such a disease exists—*ergo*, there is no such disease; the veterinary officer does know that trichinosis exists, and is in

some parts of the world prevalent and disastrous, but this knowledge scares people, it does not allow that holy man, the butcher, to pursue his calling in peace and comfort and make money as rapidly as he would like—*ergo*, the veterinary officer must be rebuked as a disturber of the peace. "Officials," says the western Solon, "should take their instructions from the committees." Fancy a man with a house full of the richest treasures buying a valuable watch-dog and training it not to bark except during the daytime when the whole household is astir! Police officers tell us that thieves and house-breakers often endeavour to get rid of the importunate barking of a watch-dog by drugging it, but it has been reserved for Glasgow Town-Council to perpetrate the folly of acting the householder who does the drugging himself in order to make the work easier for the thieves and the house-breakers. We are glad to see that the genial and sagacious Lord Provost of Glasgow ruled Mr. Scott out of order, but the discussion was only deferred, and we fear Mr. Scott will do more harm yet unless the Lord Provost finds some means of muzzling him. We earnestly commend this matter to all Veterinary and Medical Societies, and to all who have any interest in or control over the food supplies of the nation.

EDITORIAL NOTE.

We have much pleasure in congratulating Dr. WILLIAM SOMERVILLE, M.A., late Professor of Agriculture at Cambridge University, on his appointment as an Assistant Secretary to the Board of Agriculture on the retirement of Sir JACOB WILSON. We feel sure that Dr. SOMERVILLE will be a valuable addition to the Board, as he is a man of great practical experience, combined with a profound theoretical knowledge.

Royal College of Veterinary Surgeons.

AT the recent Examinations held in Edinburgh the following students from the New Veterinary College passed their Examinations :—

Class "A."—Messrs. C. Elphick, G. Petch, J. B. Schofield,* and R. H. B. Wheatley.

Class "B."—R. Elliott,* A. Barr, P. Reilly, S. Robson.

Class "C."—L. W. Lloyd,* W. D. Lindsay, A. Macfarlane, G. Nicholson, J. A. Shaw, T. Walker, A. Walker, F. H. Sugden.

Class "D." and obtained the Diploma.—Richard Scott, Ambleside; J. Bradley, Bradford; C. Pitt, Bradford; R. Finch, Ormskirk; J. Latta, Edinburgh; F. Moon, Manchester; F. Dunning,* Beverley.

* 2nd Honours.

Original Papers.

THE STRUGGLE AGAINST TUBERCULOSIS.

A Critical Examination of Professor Koch's Ideas.

(*Full Translation from the French of M. S. Arloing.*)

At the English Tuberculosis Congress held in London in July of this year (1901), Professor Koch made a startling statement on the struggle against tuberculosis, in which he strove to overthrow entirely a well-founded opinion as to one of the sources of human tuberculosis—the possibility of the transmission of tubercular infection by the passage of disease germs from the lower animals to man. It is well known that defensive measures, more or less rigorous, are in force nearly everywhere against the milk and flesh of tuberculous animals of the bovine species. Professor Koch proposes to abolish these.

In order to give more interest to his new ideas, Professor Koch attributes to his opponents an exaggerated opinion on the importance of flesh and milk in the propagation of tuberculosis. He thinks that some people regard this mode of propagation the most important. I am not aware that this is the case. I know supporters of the measures taken against milk and flesh who are not ignorant of the fact that tuberculosis of alimentary origin is rare, and that the chief source of human tuberculosis is the tuberculous man; yet, however small may be the risk of contagion from animals to man, they think it ought to be guarded against, for the human subject once contaminated becomes in his turn a formidable agent of propagation. With this reserve, I return to the essential aim of Professor Koch's communication.

The learned bacteriologist lays down a very wise principle, namely, that in the fight against infectious diseases we must attack the evil at its root and not squander our resources by prescribing useless measures. Here the evil proceeds from the penetration of the bacillus into the organism. But the bacillus is dangerous only on condition that it is identical with that which inhabits the tuberculous lesions of man. Now, in the opinion of Professor Koch, the bacillus of tuberculosis in animals, and particularly in those of the bovine species, is not identical with that of human tuberculosis; therefore bovine tuberculosis cannot be infectious for man. Consequently, measures taken against the milk and flesh of tuberculous oxen are as useless as they are vexatious and troublesome. Prophylaxy of tuberculosis ought to concern itself exclusively with the sputum of consumptives, that being almost the sole cause of tuberculous infection. The affirmations of Professor Koch rest upon two sets of principal facts. He maintains (*a*) that human tuberculosis differs from bovine, and cannot be transmitted to cattle; and (*b*) that the receptivity of man for bovine tuberculosis has not been demonstrated.

Lord Lister, M. Nocard, Dr. MacFadyean, and Professor Bang opposed the conclusion of Professor Koch, which favours the suppression of measures against the milk or flesh of tuberculous animals. It was rejected by the Congress, although by a small majority. If I had been present at the meeting, I should, in spite of my respectful admiration for Professor Koch, have increased the number of his opponents. I propose in the present

treatise to state the reasons or the facts on which I should have supported my contention.

I.—THE RECEPTIVITY OF MAN FOR ANIMAL TUBERCULOSIS.

This question, as Professor Koch says, cannot be settled by experiment. Yet M. Nocard and M. Bang have told us that there are on record certain cases of accidental inoculation of bovine tuberculosis in man which are as conclusive as experiments. But what is specially important to Professor Koch is contamination by ingestion. In this direction also M. Nocard reminds us that there are authenticated cases of infection by the use of milk from cows affected with tuberculous mammitis. It is true the proof has not been furnished by the means which Professor Koch regards as conclusive. He in fact recognises the alimentary origin of tuberculosis "only in those cases in which the intestine has sustained the first attack, that is to say, when we find original intestinal tuberculosis." Now, in the numerous post-mortem examinations which he has made, Professor Koch has observed only two cases of original intestinal tuberculosis. It is said that only ten cases have been observed in five years at the Charity Hospital in Berlin. In 933 cases of infantile tuberculosis, Baginski found none without lesions of the lungs and bronchial ganglia, and in 3104 post-mortems of tuberculous children Biedert found only sixteen cases of original tuberculosis of the intestine. In short, original tuberculosis of the intestine seems no more common than hereditary tuberculosis. Yet, Professor Koch points out, it is not proved that all these intestinal tuberculoses, undoubtedly of alimentary origin, can be traced to bovine tuberculosis.

I wish to draw attention to the criterion adopted by Professor Koch for deciding as to the alimentary origin of an infection. It is necessary, he says, that the infection be one of the intestine and remain localised there. It seems to me that this criterion is too severe. We have no proof in the numerous cases of infantile tuberculosis studied by Baginski and Biedert, in which the lesions occupied simultaneously the digestive canal, the lungs, and the bronchial ganglia, that some of them did not commence by an infection of the intestine. The propagation of lesions sometimes proceeds with such great rapidity that it is difficult to decide which are the original lesions. I will go even farther, and say that tuberculous lesions may appear at the chosen spot without the virus having left its "signature" at the point of introduction; that is to say, I admit the possibility of pulmonary tuberculosis which is of alimentary origin and yet has left no intestinal lesions. In the course of very numerous and very varied experiments which I have made in the way of experimental infection, I have observed visceral tuberculisations without tuberculous "seed-plot" at the entrance gate of the virus, or along the track followed by the infective substance. Certain animals—the rabbit, for example—present most easily cases of this kind. In short, infection has been possible by the primary digestive passages. In these cases it will assuredly not be accompanied by intestinal lesions, yet the tuberculosis of the lung will be none the less of alimentary origin. I cannot therefore regard the figures given by Professor Koch as the exact expression of the truth. It is extremely probable that they are far below the mark.

But this is not all. In order to reduce still further the danger to which we are exposed by bovine tuberculosis Professor Koch insists upon dis-

tinguishing in the insufficient number of the cases of tuberculosis of alimentary origin which he knows those which may be due to the ingestion of bovine tuberculosis from those which are due to the ingestion of human bacilli. Up to the present date we should find it very troublesome to rest this distinction on a secure basis. But Professor Koch gives us a criterion. It is sufficient to make a pure culture of the bacillus which exists in tuberculous lesions, and inoculate it under the skin of the ox; we shall thus obtain "characteristic results." Professor Koch informs us that he has not got quite into the way of this form of research, as he began it only recently. Nevertheless, what he has "obtained from these experiments up to the present time is not in favour of the transmissibility of bovine tuberculosis to man." I am sorry we cannot be informed more fully as to these experiments, especially on the characteristic results of the inoculation of pure culture under the skin of cattle. What are these results to be? As far as I am permitted to judge of this from another part of Professor Koch's paper, if the tuberculosis is of bovine origin, "after a period of incubation, say a week, the largest tuberculous lesions are produced in the organs of all the animals injected." Consequently the visceral generalisation of tuberculosis after the subcutaneous inoculation of the culture in a young bullock will be the characteristic mark of the animal origin of the infection. I greatly doubt if the result will always be as characteristic as Professor Koch believes. I happen to have inoculated bovine tuberculosis in the subcutaneous conjunctive tissue of young bullocks, but I did not obtain visceral tuberculous lesions. The effects were confined to local lesions, and to the appearance of tuberculous foci in the nearest ganglion to which the lymphatics starting from the inoculated region converge. I know from experiments made formerly by M. Chauveau that the results of these inoculations generally occur in this way. Therefore I cannot admit at the present time that Professor Koch is entitled to pronounce always with certainty on the question of the receptivity of man for tuberculosis. Further, his ideas are not yet clearly developed. He does not venture to reject entirely the possibility of infection to man from the milk or flesh of tuberculous animals. He pronounces solely but precisely on the *rarity* of this infection. But that is just what the most of us say on the subject.

II.—IS HUMAN TUBERCULOSIS DIFFERENT FROM BOVINE TUBERCULOSIS?

Professor Koch pronounces in the affirmative. He reminds us that at the very beginning of his studies on tuberculosis he recognised a profound difference between aviary and human tuberculosis, and that he expressed himself with reserve as to the identity of bovine and human tuberculosis. His suspicions are now transformed into certainty, thanks to experiments which he has performed on the calf, with the co-operation of Professor Schütz, of the Veterinary Faculty at Berlin. These experiments consisted in choosing young calves which the tuberculin test declared to be immune to tuberculosis, and in inoculating these with pure cultures of bacilli from human tuberculosis, either under the skin or in the peritoneum and jugular vein; or, on the other hand, in making them swallow the sputa of consumptive persons in the course of several months; or, finally, in making them inhale bacilli in suspension in "pulverised" water. Experiments were carried on simultaneously on other calves with bacilli from an animal

affected with bovine tuberculosis. Now, whilst "not one of the animals of the former category presented the slightest morbid symptoms," nor any tuberculous lesions in the viscera, but only small purulent foci with a few bacilli at the points of inoculation, those of the second showed the most serious tuberculous lesions, both local and general; some of them died at the end of a month and a half or two months after inoculation, the others were slaughtered in a pitiable condition at the end of three months.

Professor Koch says that experiments in the way of alimentation made upon the pig would enable us to distinguish clearly between human and bovine tuberculosis. "Finally," he adds, "the difference between human and bovine tuberculosis did not show itself less distinctly in a similar experiment performed on asses, sheep, and goats into the vascular system, of which we injected the two kinds of bacilli." To sum up, in the various experiments performed by Professor Koch, whatever the channel selected for producing infection, the virulent agent of human origin failed, whilst the virus of bovine origin was remarkably infective. Professor Koch believes himself entitled to quote, in support of his labours, experiments performed in the past by Chauveau, Günther, Harms, Bollinger, and others, in which ruminants and omnivora having received tuberculous lesions by means of ingestion, were infected when the lesions came from the ox, and remained immune when they came from man. The conclusion which we draw from all these facts may be summarised as follows:—Human tuberculosis cannot be transmitted to ruminants, solipeds, or swine; therefore it differs from bovine tuberculosis. I propose to examine this conclusion and see up to what point it is legitimate,—first by examining the experiments personally performed by Professor Koch and those which he claims as supporting his contention, and then by detailing experiments conducted by myself.

(*a.*) M. Nocard has already drawn attention at the sitting of the Congress to the fact that M. Chauveau's experiments do not entirely support Professor Koch's thesis. In support of M. Nocard I may say that M. Chauveau has successfully infected calves, by way of the intestines and of the veins, with recent tuberculous granulations or caseous masses taken from man. These are positive facts, which subsist in spite of the negative facts collected by our eminent colleagues in Berlin.

(*b.*) Let us now examine Professor Koch's experiments. If those performed on the calf have given very clear results, it is not so with those performed on the pig. As a matter of fact, on animals of the porcine species which have received the sputa of consumptive patients there were found here and there nodules in the ganglia of the neck, and in one case some granulations in the lungs. These lesions give distinct traces of tuberculous infection—slight, I admit, but such as to prevent us from stating that in all the animals which had received sputa, there was no trace of tuberculosis, and that the differences between bovine and human tuberculosis was as distinct here as in the experiments on the calf.

(*c.*) Perhaps this is the place for recalling the fact that I have for long maintained the unity of true tuberculosis, namely, that in which we find the Koch bacillus, with its fundamental characteristics, and that I explain the pathogenic differences observed in experiments by variations in the virulence of the bacillus, and by the degree of susceptibility shown by the various animal species, nay, even by individuals. Two of my pupils demonstrated in 1891 that the bacillus of avian tuberculosis was a variety of the bacillus of tuberculosis of the mammalia, and that long-extending adap

tation to the organism of birds had withdrawn from it some of its original qualities. It was possible for these two gentlemen to restore a great part of the said qualities. This declaration was somewhat coldly received when first propounded as a principle, but a number of books and papers written since then, down to the work which M. Nocard produced at the Tuberculosis Congress at Paris in 1898, have confirmed it many times over.

(*d.*) As to the lesions of human origin, they have not necessarily and always the same virulence. I have demonstrated that the so-called scrofulous ganglionary lesions, that a great number of surgical tuberculosis easily borne by those troubled with them, and fairly easily curable, were less virulent than the majority of the tuberculous lesions of the viscera and of the serosæ. The latter infect the rabbit and the guinea-pig when inoculated subcutaneously, whilst the former infect only the guinea-pig. I have shown also that certain tuberculous lesions which at the outset infected only the guinea-pig, raised themselves after several passages through the organism of that animal so far as to tuberculise the rabbit.

We thus see that tuberculous virus may exist in the human organism at various degrees of activity, and that the more or less clearly marked susceptibility of this or that animal, permits us to discover these degrees. Nay more, we see that tuberculous virus, weakened before or after its entrance into the human body, is capable of recovering a part of the activity which it has lost by reproducing itself several times in succession in the body of the guinea-pig. The weakening of the tuberculous virus may thus be verified in the human subjeet outside of the ganglionary, articular, and osseous lesions.

Along with M. Jules Courmont I have observed several degrees of virulence in lupus. In addition, Messrs. Courmont and Denis have studied in my laboratory pulmonary tuberculosis with attenuated bacilli infecting the guinea-pig, but not tuberculising the rabbit—analogous, therefore, to the surgical tuberculosis which I have mentioned previously. I know quite well it has been maintained that the differences which I have pointed out between certain surgical tuberculoses and the greater number of visceral tuberculoses were owing rather to the rarity of bacilli in the latter than to a modification of the virulence. Bul I have shown over and over again in my writings that it *was* a question of changes in the virulence. Besides, now-a-days, very few bacteriologists would maintain that tuberculous virus forms an exception to other forms of virus in escaping causes of attenuation.

(*e*) Furthermore, I will report other facts which will prove that the bacilli of human tuberculosis, cultivated in a state of purity outside of the organism, undergo or may undergo an attenuation in their virulence. Cultures capable of infecting rabbits and guinea-pigs sometimes, after a great number of generations, arrive at a stage when they can no longer tuberculise the rabbit by subcutaneous inoculation. By successive cultivations (and availing myself of the help of selections) I have succeeded in growing a human bacillus in suspension in glycerinised broth, in such a way as to obtain homogeneous cultivations. I have preserved this human bacillus for several years. At the present time, dose for dose, it no longer tuberculises the rabbit by subcutaneous injection, and only produces from time to time, on guinea-pigs, probably more predisposed than others, a few rare tubercles in the lungs. When injected into the blood of the rabbit it produces simply hypertrophy of the spleen, and causes the death of the animal by emaciation. If we made use merely of the rabbit and of

subcutaneous and intravenous channels it would be impossible to attribute to this bacillus tuberculising properties. And yet it does still possess them. They may be rendered evident by injecting the culture in the serosæ; there it produces typical tuberculous granulations rich in Koch bacilli. If in the above experiments we had been unaware of the paternity of the virulent lesions or of the pure cultures, we might have supposed that we had to deal with different tuberculoses, but, knowing this, we are compelled to admit that we have simply been present at the birth of mere varieties of a given species. Thus the human bacillus does not cease to be itself, although it may lose or regain the capacity for tuberculising the rabbit. Passing from tube to tube or from animal to animal, the virus or the bacillus may lose its original power or gain a greater. Further, the virulence adapts itself after a time to the organism in which it reproduces itself. Finally, even in those species in which tuberculosis works the greatest havoc, the virus may become attenuated. In all cases, when transported suddenly to an animal species more resistant to tuberculosis than the species which had hitherto harboured it, tuberculous virus may appear all at once to have lost a great part of its force. Man, as we have said, may gather and create varieties of bacilli of feeble virulence.

It is possible Professor Koch has experimented with a variety of varieties of feeble virulence, for I have had in my possession human bacilli with the help of which I have tuberculised animals, which, according to Professor Koch, ought to have been infectable only with the bacilli of bovine tuberculosis. This will be seen in the next section.

III.—HUMAN TUBERCULOSIS MAY BE TRANSMITTED TO THE GOAT AND THE ASS.

I now come to my most cogent arguments.

Professor Koch has said that human tuberculosis cannot be transmitted to cattle, therefore human tuberculosis differs from bovine. By cattle he means, in addition to the ox, the pig, sheep, goat, and ass, as these animals are mentioned in his London address as on the same footing as the calf. If I were to show that the goat and the ass can be tuberculised with a pure culture of human bacilli, the principal foundation of Professor Koch's assertions would disappear. I shall proceed to do so.

I possess in my laboratory, on glycerinised potatoes, a very virulent bacillus of human tuberculosis, with which I have performed intravenous injections on the ass and goat, and subcutaneous injections on the guinea-pig and cow, as well as intraperitoneal on the rabbit. The cultures of this bacillus on the solid medium in question were habitually rich, and quite characterised by the appearance and consistency of the colonies.

Inoculation of the Ass.—Many experimentalists have failed to tuberculise the ass,—for example, M. Nocard. Others have obtained a positive result, but I cannot say whether in the successful cases the infective matter came from the ox or the human subject. I am going to quote cases in which the bacillus was indisputably of human origin.

A few clots of the above-mentioned culture were taken up and pounded into minute pieces in sterilised broth. The emulsion was passed through a piece of very close sieve-cloth, previously sterilised by boiling in water, and then injected into the jugular of two asses,—28th September 1806. One of the patients, which was aged and somewhat feeble at the moment

of injection, grew gradually weaker from 13th October onwards, and died on the 26th, without having shown any feverish temperature. The other, young and vigorous, never ceased to present a satisfactory general condition, the rectal temperature rose about one degree in the course of the first month, then varied between 37·5 and 38° (Cent.). It was slaughtered on 28th November. The autopsy of the two animals was made with care. The lesions were all concentrated in the thorax. On the first animal (which had died in less than a month) the lungs showed here and there congestive lesions, and throughout all their extent, but especially in the anterior lobule of the left lung, little tubercles, giving to the finger the sensation of distinctly marked grains. On the second animal the lesions in the lungs were more perceptible to touch than to sight. On passing the fingers over the surface of these organs one could feel a great number of very circumscribed points in which the consistency of the tissue was increased. These points probably represented tuberculous nodules in retrogression. Histological examination showed, on the old ass, tuberculous granulations, more or less accompanied by simple inflammatory lesions, resembling the classic type. On the young ass one could still notice tuberculous granulations quite well, but one saw besides that they were invaded by conjunctive tissue gradually stifling the cellular elements.

The experiment performed on these two animals thus shows (*a*) that certain pure cultures of human bacilli may tuberculise the ass; and (*b*) that the ass seems to recover spontaneously from pulmonary tubercles produced by an intravenous injection of human bacilli, as M. Chauveau has already noticed.

I was anxious to unite in the same lung active tubercles and tubercles in a state of fibrous retrogression. For that purpose I put into the jugular vein of a third ass two injections of bacilli at an interval of fifteen days. All precautions were taken not to inoculate the walls of the veins. From 37·6° the temperature rose to 38·6° in the course of a few days after the injection; it reached 39° after the second injection, then varied between 37·2° and 37·9° On the 2nd May, after an injection of tuberculin, the temperature rose 2·7° above the normal, and thus the inoculations seemed to have succeeded perfectly. The animal was bled to death on the 27th May. The autopsy showed the existence in the lung (*a*) of a multitude of small elevations, bright at the top, here and there surrounded by an aureole of congestion; (*b*) of a great number of circular blotches, having the diameter of a lentil, without projections, indicated specially by a whitish tint. On histological section one perceived that the bright, consistent elevations represented tuberculous granulations, isolated, or touching one another. The peripheric elements, the epithelioid cellules which constituted them seemed in full activity and surrounded giant cellules of wonderful distinctness. As for the circular white blotches, they were formed of masses of cellules plunged in the midst of connective fibrillæ. They were evidently tuberculous granulations, the cellular elements of which were gradually giving way to connective fibrillæ. In all the cases tuberculisation of the lungs had had very little influence on the lymphatic system, for the bronchial, œsophageal, and pre-pectoral ganglia were not swollen; only one of them presented one or two little tubercles.

Inoculation of the Goat.—On 20th April 1899 seven goats received into the jugular vein a sifted emulsion of Koch bacilli, of human origin, which had been taken from a culture on solid medium (glycerinised potato).

Four goats had received as a preliminary subcutaneous injections—spread over a considerable time—either of eucalyptol, guiacol, creosote, or corrosive sublimate. Three goats were normal, and were intended to serve as "controls" to the four first. Two of the "control" goats succumbed, one on the 9th, the other on the 18th May. The first four and one control goat survived till the 8th July, and were then slaughtered. In order to detail the results of the intravenous inoculation I will divide these animals into two groups, the first of which will include the goats which succumbed in May. These two animals rapidly developed alarming symptoms—cough, difficult and hurried respiration, rapid pulse, frequent meteorisation, continuous hyperthermia (reaching sometimes 41·1°), emaciation amounting to 3 kilograms. At the autopsy I noticed considerable lesions in the lungs; these were sprinkled with small nodular masses, sunk in a parenchyma inflamed to hepatisation at certain points. On one goat I found a few granulations in the liver. I crushed these down, and did the same with the granular lesions of the lungs, and on this mass I coloured a few Koch bacilli by the Lubimoff process. The five goats which were preserved from 21st April to 8th July presented all the signs of infection, but in different degrees. All showed hyperthermia during the few days which followed the intravenous injection, all commenced to cough on the eighth day, and went on to the twelfth, the cough coming in more or less frequent fits; all became emaciated. The control goat lost 7 kilos., the creosoted 10, the guiacolated 8½, the goat dosed with sublimate 2, the one with eucalyptus 2. During June their temperature varied from 39·1° to 39·7°.

At the autopsy all the goats showed tuberculous eruption in the lungs, interposed in some cases between old or new verminous lesions. The eruption was composed of granulations, the largest of which had the diameter of a millet-seed. It was found everywhere, but it was at its maximum of confluence on the anterior lobes of the lungs. The ganglia at the entrance of the chest, and those which accompany the œsophagus, were more or less swollen. Histological examination confirmed the tuberculous nature of this eruption. Some granulations presented a beginning of caseous degeneration in the centre.

Inoculation of the Guinea-pig.—The same culture was inoculated under the skin of the thigh in four guinea-pigs on 21st April 1899; they died on 6th June from generalised tuberculosis.

Inoculation of the Ox.—The same culture was injected under the skin of the supra-nasal region of a heifer, the dose being a cubic centimetre. Tuberculous swellings (gummata) gradually developed at the point of inoculation. The lymphatic ganglia of the maxillary region became slightly swollen. A very long time after inoculation the subcutaneous swellings (gummata) softened and opened spontaneously. The tuberculosis did not extend to the viscera.

Inoculation of the Rabbit.—Injected into the peritoneum of the rabbit the emulsion produced an eruption of tubercles on the epiploon, and on some parts of the parietal and visceral peritoneum. On breaking down these tubercles I coloured some Koch bacilli.

The subcutaneous inoculations practised on the guinea-pig and ox, as well as the peritoneal inoculations practised on the rabbit, were intended to test the tuberculising power of any culture, in case intravenous inoculations should have given doubtful or uncertain results. In the particular case they were superfluous.

We now see that there exist bacilli of human origin maintained in pure cultures which are capable of tuberculising the goat and the ass by intravenous injection, of producing in some of these animals a grave general condition, and even of causing death. We see also that the same bacilli introduced under the skin of the ox confine themselves to producing local accidents. These experiments are therefore so many positive results which countervail the negative results obtained by Professor Koch.

IV.—CONCLUSIONS.

The criterion set up by Professor Koch in order to show that human tuberculosis differs from bovine, is shown to be imperfect. The facts which I have related, apart from any experiments on the ass and goat, show that the virulence of the bacillus of tuberculosis is frequently modified, even in the organism of an animal species, and also that it adapts itself to this or that living medium by a series of transmissions. Consequently we must expect to find in the Koch bacilli, when established in different animal species, differences and modifications in their virulence. But these variations do not affect the fundamental qualities of the bacilli, which may reappear at any moment with typical intensity. Professor Koch has himself found this in his trials of infection on swine. We may therefore feel legitimate astonishment on finding that the learned discoverer of the bacillus of tuberculosis has made a clean sweep of all these considerations, as well as of the positive results obtained by other investigators, and that, relying on a series of negative results, he has declared that there is an absolute difference between the two kinds of tuberculosis, thus undermining the precautionary measures considered useful by most hygienists. Let us of course struggle energetically against inspection by the sputa of consumptives, but do not let us cease to watch as far as possible the milk and flesh of tuberculous animals.

REGULATIONS FOR THE INSPECTION AND SAFE TRANSPORT OF ANIMALS FROM THE UNITED STATES TO FOREIGN COUNTRIES.

INSPECTION AND SHIPMENT.

1. *Animals subject to inspection.*—The Chief of the Bureau of Animal Industry is hereby directed to cause careful veterinary inspection to be made of all cattle, sheep, and horses to be exported from the United States to Great Britain and Ireland and the continent of Europe. The word "horses" when used in these regulations refers to and includes mules and asses.

(a) *Cities where animals may be inspected.*—This inspection will be made at any of the following-named stock yards:—Chicago, Ill.; Kansas City, Mo.; Omaha, Nebr.; St. Joseph, Mo.; National Stock Yards, Ill.; Indianapolis, Ind.; Buffalo, N. Y., and Pittsburg, Pa.; and the following ports of export, viz.—Portland, Me.; Boston, Mass.; New York, N. Y.; Philadelphia, Pa.; Baltimore, Md.; Norfolk and Newport News, N. A.; Port Royal, S. C.; New Orleans, La., and Galveston, Tex. All cattle shipped from any of the aforesaid yards must be tagged before being

shipped to the ports of export. Animals arriving at ports of export from other parts of the United States will be inspected and cattle tagged at said ports.

(b) *Animals allowed shipment.*—After inspection of the aforesaid stock yards, only animals found to be sound and free from disease, and shown not to have been exposed to the contagion of any disease, shall be allowed shipment, and all cattle so inspected and passed shall be tagged under the direction of the inspector in charge of the yards. After inspection the animals passed shall be loaded into clean and disinfected cars.

(c) *Clean cars, yards, &c. required.*—All animals shall be inspected or reinspected at the port of export. All railroad companies will be required to furnish clean and disinfected cars for the transportation of cattle, sheep, and horses for export, and the various stock yards and stable owners located at the ports of export shall keep separate, clean, and disinfected stock yards and pens or stables for the use of export animals.

(d) *Identification of animals.*—Shippers shall notify the inspector in charge of the yards of intended shipments of animals, the number and designation of cars in which they are to be shipped, and shall inform said inspector of the locality from which said animals have been brought, the name of the feeder of said animals, and such other information as may be practicable for proper identification of the place from which said animals have come.

(e) *Notification of shipment to ports.*—The inspector, after passing said animals, and after the cattle have been tagged, shall notify the inspector in charge of the port of export, and also inspectors located at intermediate cities, where the animals may be unloaded for feeding and watering, of the inspection and shipment of such animals, advising him of the number and kind of animals shipped, tag numbers, and the number and designation of the cars in which said animals were shipped.

(f) *Transportation from yards to steamers.*—Export animals shall not be unnecessarily passed over any highway, or removed to cars or boats which are used for conveying other animals. Boats transporting said animals to the ocean steamer must first be cleansed and disinfected with lime wash under the supervision of the inspector of the port, and the ocean steamer must, before receiving said animals, be thoroughly cleansed or disinfected in accordance with the directions of said inspector. When passage upon or across the public highway is unavoidable in the transportation of animals from the cars to the boat, it must be under such careful supervision and restrictions as the inspector may direct.

(g) *Animals not allowed shipment.*—Any cattle, sheep, or horses that are offered for shipment to Great Britain or Ireland or the continent of Europe which have not been inspected and transported in accordance with this order and these regulations, or which, having been inspected, are adjudged to be infected or to have been exposed to infection so as to be dangerous to other animals or otherwise unfit for shipment, shall not be allowed to be placed upon any vessel for exportation.

(h) *Supervision to steamers.*—The supervision of the movement of animals from cars, yards, and stables to the ocean steamers at the ports of export will be in charge of the inspector of the port.

(i) *Clearance and certificates.*—The inspector at the port of export will notify the collector of the port or his deputy of the various shipments of animals that are entitled to clearance papers, and when authorised certifi-

cates of the inspection of said animals may be given to the consignors for transmission with the bills of lading.

(j) *Notification to Inspectors of shipments on steamers.*—The exporters of live stock or the owners, agent, or master of any vessel desiring to transport cattle, sheep, or horses from any port of the United States where inspection is established to Great Britain, Ireland, or the continent of Europe, shall notify the inspector in charge of the port from which said vessel is to clear at least two days in advance of such intended shipment, and if the regulations prescribed have been complied with a clearance will be authorised by such inspector.

SPACE.

2. *Space not allowed to be used.*—Animals exported must not be carried on any part of the vessel where they will interfere with the proper management of the vessel, or with the efficient working of the necessary lifeboats, or with the requisite ventilation of the vessel, and only as hereinafter specified.

(a) *Cattle.*—Cattle must have 6 feet vertical space on all decks, free of all obstructions; dehorned cattle may, however, be placed on raised floors over pipes and other similar obstructions where the vertical space is 5 feet and 6 inches. Cattle carried on the upper or spar deck, or other exposed decks, must be allowed a space of 2 feet 6 inches in width by 8 feet in depth per head. Cattle loaded under decks must be allowed a space of 2 feet 8 inches in width by 8 feet in depth, except in the case of regular cattle ships with satisfactory ventilation, which may fit with an allowance of 2 feet 6 inches in width. No more than four head of cattle will be allowed in each pen, except at the ends of a row, where five may be allowed together. Provided, however, that cattle under 1000 pounds in weight may be allowed a width of 2 feet 3 inches. Cattle in single stalls shall have 3 feet in width.

Vessels will be allowed to carry three deck loads of cattle, but where it is desired to carry cattle on the lower or steerage deck it must in all cases be fitted at 2 feet 8 inches by 8 feet per head, and no animals allowed upon hatches. Special permission for carrying cattle on steerage deck must be obtained from the inspector, which will be granted in cases where said deck is provided with sufficient ventilation, as hereinafter prescribed.

(b) *Sheep.*—The space for each full-grown sheep shall be 4 feet long by 14 inches wide, and for lambs or sheep under 100 pounds weight 4 feet by 12 or 13 inches—two rows of sheep standing in the 8 feet width of pen.

Sheep pens shall not exceed 20 feet by 8 feet where two tiers are carried, and each tier shall have a clear vertical space of not less than 3 feet. During the summer season sheep shall not be kept in tiers under decks, but during the winter season two tiers may be placed in each wing, and only one tier amidships. One single deck of sheep may be carried upon the shelter decks for cattle when the cattle shelter decks are permanently built, and are composed of tongued-and-groved boards, provided such sheep fittings do not conflict with the first paragraph of this section. Such fittings shall be secured to the shelter deck in the manner provided by section 3 of these regulations.

(c) *Horses.*—All horses must have 6 feet 3 inches clear vertical space from beams of deck overhead to deck under foot, and so far as possible

shall be placed between the overhead athwartship beams. Horses must be allowed a space of 2 feet 6 inches in width by 8 feet in depth; an additional space may be required by the inspector for very large horses. Separate stalls must be erected for all horses. When horses are placed directly under athwartship beams the beams must be guarded by 4-inch strips of wood fastened to both sides of the beam. A space 8 by 10 feet square must be reserved on each steamer carrying twenty-two or more horses for use in caring for horses becoming sick in transit. Horses, when placed in the same compartment with cattle, must be separated by fore-and-aft alleyways and temporary athwartship bulkheads, the length of which shall not be less than the depth of the stalls.

UPPER DECKS.

3. *Upper decks.*—No animal shall be allowed on the poop deck or within 20 feet of the breakwater on the spar deck between the 1st of October and the 1st of April. If cattle or sheep are carried on the bridge deck proper runways shall be provided for loading and unloading. Horses shall not be allowed upon the bridge deck except when this deck is completely covered in and fitted for horses. Horses shall not be allowed upon the spar deck when temporary fittings are used between October 1st and April 1st. No cattle or horses shall be carried upon the upper decks where the outside rails measure less than 3 feet in height from the deck. When animals are carried upon the upper decks strong breakwaters should be erected at each end and on both sides. Permanent fittings may be constructed either of iron or wood, as hereinafter specified.

(a) *Alleyways.*—All steamers now engaged in carrying cattle, sheep, and horses for export, and which are permanently fitted, may receive such animals for transportation upon the approval of the deck plans by the Chief of the Bureau of Animal Industry. Such plans must be submitted for approval, and required alterations made before July 1st next. All other steamers will be required to provide alleyways as provided by this section. Alleyways in front and between pens used for feeding and watering cattle must have a width of 3 feet, except at ends of alleyways in bow and stern of ship, and where obstructions less than 3 feet in length occur, the width may be reduced to a minimum of 18 inches; alleyways in front and between pens used for feeding and watering horses must have a minimum width of 3 feet. Two or more athwartship alleyways at least 18 inches wide must be left on each side of deck, so that the scuppers can be readily reached and kept clear of obstructions. For sheep athwartship alleyways not less than 18 inches wide in the clear shall be left between pens and fore-and-aft alleyways 3 feet wide in front of each pen except at obstructions and at ends of alleyways, as provided for cattle, there may be a minimum width of 18 inches. When two tiers of sheep are carried, the minimum width of the fore-and-aft alleyways in bow and stern of ship shall be 2 feet clear of all obstructions. Sufficient space must be left at the sides of hatches to permit the feed in the hold to be readily removed and handled.

(b) *Stanchions, wooden, and rump boards.*—Stanchions at least 4 inches higher than the required vertical space for cattle and horses must be 4 by 6-inch clear hard pine or spruce of equal quality, placed at proper distances from centers, against the ship's rail and inside stanchions, in their proper place directly in line with outboard stanchions, and to be set up so that

the 6-inch way of the stanchions shall set fore and aft. A proper tenon shall be cut on the head of the same to receive the thwartship beam; the tenon not to be less than 3 inches in length, and the shoulder not less than 2¼ inches on each side of the stanchion, thus leaving the tenon 1½ inches thick. A piece of 2 by 3 inches, or 2-inch plank, shall be fastened to the outside of stanchion and run up to underneath rail to chock stanchion down and prevent lifting when beam is sprung to crown of deck. Open-rail ships shall be blocked out on backs of stanchions fair with the outside of rails to receive the outside of planking. Where upper-deck fittings are not permanent, the heels of outside stanchions shall be secured by a bracing of 2 by 3-inch sound lumber from the back of each stanchion to sheer streak of waterway, the heels of inside stanchions being properly braced from and to each other. Bulwark stanchions must also be extra stanchioned by raking shores running diagonally from the top of the stanchions to the deck. Rump boards must be provided on all decks where the iron frame-work and other obstructions of the ship are liable to bruise animals tied next to same, and at such other places where required for the safety of the animals, and should be closely fitted behind rows of cattle in all cases where necessary to prevent escape of manure into alleyways. For horses, wooden stanchions, as above described, must be placed at proper distances for each horse.

(b) *Stanchions, iron.*—These may be used in place of wooden stanchions, and shall not be less than 2 inches in diameter, set in iron sockets above and below and fastened with ⅝-inch bolts. For horses the same number of iron stanchions are required as when wooden stanchions are used.

(c) *Hook bolts or clamps.*—Hook bolts or clamps must be made of ⅝-inch wrought iron, with hook on outboard end and thread and nut on inboard end, to pass over and under rail and through outboard stanchion and set up on the inside of same with a nut. These bolts may be double or single. If double, then no thread or nut is necessary, but the stanchion will be slipped through it, thus double-hooking the rails. This will be found very useful where funnels or other deck fittings come in the way of beams passing from side to side of ship.

(d) *Beams.*—Beams must be of good sound spruce or yellow pine lumber 3 by 6 inches, to run clear across the ship's beam where practicable. Should any house or deck fittings be in the way, then butt up closely to the same. These beams shall have a 1½ by 4 inch mortice to receive the tenon of each and every stanchion, and to take the same crown as deck of ship by springing down to shoulder of outside stanchions, and to be properly pinned or nailed to tenon and wedged tightly afterwards. The mortises shall be cut not less than 6 inches from outside ends of beams and a piece nailed on outside of same and trimmed off fair with beam ends to prevent splitting.

(e) *Diagonal braces from stanchions to beams.*—Diagonal braces shall be fastened on each stanchion on both sides of same, running up to top side of beam and properly secured by well nailing to both stanchions and beam.

(f) *Headboards.*—Headboards shall not be less than 2 by 10 or 3 by 8 inches, of good sound spruce or yellow pine lumber, and secured at every stanchion by ⅝-inch screw bolts passing through same and set up on same with a nut. Where headboards butt on the stanchions a piece of iron ¼ inch thick and 3 inches square shall be placed over the boards like the

butt strap. These headboards can be placed on either side of the stanchion. All headboards shall have 1¼-inch holes bored through them at proper distances to tie the animal.

(g) *Headpipes.*—In place of wooden headboards two wrought-iron pipes not less than 2 inches in diameter may be used, placed 8 inches apart. Said headpipes to be made continuous by having a wrought-iron threaded collar securely fastened on the end of each length of pipe into which the next length may be inserted or screwed. Both headpipes to be held in place by means of heavy wrought-iron straps bolted to each stanchion by four ⅝-inch bolts, the lower headpipe being fitted with moveable clamps, holding a ring of suitable size to which cattle may be tied; said clamps to be set at a proper distance apart, in accordance with the regulations, and fastened to the pipe with screws.

(h) *Footboards.*—Footboards shall be of wood and of the same dimensions as headboards, properly nailed or bolted to stanchions on the inside of same.

(i) *Division boards.*—Division boards for cattle shall be of 2 by 8 inch sound spruce or yellow pine, fitted so as to be removable at any time and so arranged as to divide the animals into lots of 4, except at the ends of rows and when cattle weighing less than 1000 pounds are carried, thus making compartments for this number all over the vessel. These division boards shall be fitted perpendicularly.

(j) *Division pipes.*—In place of wooden division boards 3 wrought-iron pipes, not less than 2 inches in diameter, may be used, placed 6 inches apart, athwartship, set in iron sockets above and below and fastened with ⅝-inch bolts.

(k) *Division boards for horses.*—Division boards for horses shall be not less than 2 by 9 inches by 8 feet, sound lumber, planed, and placed horizontally between the horses.

(l) *Flooring.*—Where flooring is required it shall be of 1-inch spruce boards, laid fore and aft on ships with wooden decks. Iron-decked ships shall be sheathed with 2-inch spruce or yellow pine or with 1-inch spruce; but if 1-inch lumber is used the foot locks shall be 3 by 4 and laid so that they will properly secure the 1-inch boards, thus preventing them from slipping and at the same time acting as foot locks by showing a surface of 2 by 4 inches. It is optional with the owners whether they permit sheathing to be used on their ships with wooden decks or whether they allow foot locks to be secured to the deck. But on iron decks it is absolutely necessary (if permanent foot locks are not down) to sheath them before putting down foot locks in order to fasten same. Cement, diagonally scored ⅜-inch deep, may be used on iron decks instead of wood sheathing if the foot locks be moulded in same and bolted to the deck. If the flooring is raised on any of the decks, it shall not be less than 2 inches thick, with scantlings 2 by 3 inches thick laid athwartships on the deck, not over 18 inches apart, with 2-inch plank for flooring nailed to them.

(m) *Sheep pens.*—When the pens are built for two tiers the flooring between the tiers shall be laid with tongued-and-grooved boards; the stanchions shall be 4 by 6 inch spruce lumber and shall be secured to the beams overhead by angle braces similar to cattle fittings. Outside planking for sheep pens shall be of 2-inch spruce or 1½-inch yellow pine lumber, secured to 4 by 6 inch spruce stanchions, with hook bolts similar to cattle fittings.

(n) *Foot locks.*—Foot locks shall be of good sound spruce or yellow pine lumber or hard wood, size 2 by 4 inches, laid flat side down and fore and aft, placed 12 inches, 14 inches, 2 feet 2 inches, and 14 inches apart, the first one distant 12 inches from the inside of footboard. Where temporary fore-and-aft locks are used they shall be filled in athwartships opposite each stanchion, properly secured to sheathing or deck, and secured by a batten of spruce or yellow pine 2 by 3 inches thick to go over all, from stanchion to stanchion. Where permanent foot locks, securely bolted to iron decks, are used, the athwartship braces between foot locks, from stanchion to stanchion and batten, may be omitted when the stanchion is securely fitted in iron socket bolted to the deck. Uncovered iron decks may be arranged for cattle with athwartship foot locks, 2 by 4 inches, laid flat side down, and must be placed between the first and second, second and third, third and fourth fore-and-aft foot locks, to be at equal distances from each other, thus forming a space for each animal, and must be securely fastened to decks. In pens at each end of rows where five cattle are carried, there must be additional athwartship foot locks provided. When troughs are used fore-and-aft foot locks will be placed 17, 16, 22, and 16 inches apart. A space of 2 inches may be left between the ends of athwartship foot locks and fore-and-aft foot locks when the former are securely bolted to the deck. When fore-and-aft foot locks are permanent a 2-inch space shall be left between ends at the end of each section. Vessels now fitted with 3 by 4 inch foot looks will not be required to use 2 by 4 inch foot locks except when the former are replaced.

(o) *Outside planking.*—All outside planking on open and closed rail ships must be properly laid fore and aft of ship, and nailed to the backs of stanchions, as close as possible for the cold season, and for the warmer months the top-course planking shall be left off fore and aft of ship in order to allow a free circulation of air. Nothing less than 2-inch spruce or $1\frac{1}{2}$ inch yellow pine is to be used for this purpose.

(p) *Shelter deck planking.*—The planks to form the shelter deck, which must be erected on all exposed decks, shall be laid with 2-inch sound spruce or yellow pine lumber or with $1\frac{1}{2}$-inch sound spruce or yellow pine lumber if tongued and grooved, sufficient to cover cattle. These planks shall be laid as closely as possible, and well nailed to the beams, thus making a good deck from which to work the ship's gear.

(q) *Nails.*—No nails less than 20-penny shall be used in foot locks or where 2-inch material is used. Twelve-penny nails must be used in $1\frac{1}{2}$-inch plank or under.

(r) *Cattle fittings over spar deck.*—No cattle fittings shall be erected over permanent spar-deck fittings forward and aft of the midship section until permission has first been obtained from the Chief of Bureau of Animal Industry.

UNDER DECK.

5. *Hatches over spar decks.*—When the fittings on the spar deck are permanent, and hatches overhead are provided, the same regulations for ventilation shall apply as provided for under decks.

(a) *Alleyways.*—Alleyways shall be of the same dimensions as those of the upper decks.

(b) *Stanchions.*—Stanchions shall be of clear hard pine or spruce of equal quality, 4 by 6 inches, set up at proper distances from centres, so that

the 6-inch way of same shall stand fore and aft, and jammed in tight between the two decks, properly braced on head and from side to side of ship. This bracing shall be of 2 by 3-inch spruce or yellow pine, and be properly butted against each stanchion. Where it is found impracticable to run these braces across ship by reason of hatches, &c. coming in the way, they shall be well braced from hatch coamings and from the obstructions which prevent running braces from side to side. The heads of these stanchions shall be braced fore and aft by 2 by 3 inch pieces well nailed on each stanchion and running fore and aft close up to the lower edge of the ship's beams, and butted at each end of compartment and against themselves, or chocked in underneath beam and well nailed to heads of stanchions. If upper and lower decks are wood, then the stanchions set up between decks may be secured by well cleating to each deck at heads and heels of same.

(c) *Headboards.*—Headboards shall be of the same dimensions and same material as those on the upper deck, and fastened and arranged in the same manner.

(d) *Footboards.*—Footboards shall be of the same dimensions and same lumber as those of the upper deck, and fastened in the same manner.

(e) *Division boards.*—Division boards shall be of the same dimensions and material as those of the upper decks, and fastened and arranged in the same manner.

(f) *Flooring.*—Where ships have decks of wood it shall be optional with owners whether they have boards put down to protect decks or whether they allow the foot locks to be nailed to the ship's deck. (Permanent foot locks may be put down.) If the decks are of iron, then wooden flooring must be laid either on a 2-inch spruce with 2 by 4 inch foot locks, or of 1-inch spruce with 3 by 4 inch foot locks, same as provided for upper decks. Iron decks may be covered with cement or fitted with athwartship foot locks, as provided for iron upper decks.

(g) *Foot locks.*—Foot locks shall be arranged the same as provided for upper decks.

(h) *Troughs.*—Suitable troughs may be built on the footboards, about 12 inches wide, when required for cattle, on either deck, by fastening footboards on outside of stanchions and fitting up on the inside. When it is desired to feed small grain or ground feed the trough shall be raised two inches above the deck to prevent the feed becoming wet. Removable troughs must be used for horses. Suitable troughs for grain and water must be provided on three sides of each sheep pen.

(i) *Casing for steering gear.*—Suitable casing must be placed over the ship's steering gear when found necessary.

VENTILATION AND LIGHT.

6. *Number of ventilators for each compartment.*—Each under-deck compartment not exceeding 50 feet in length must have at least four bell-mouth ventilators of not less than 18 inches in diameter and with tops exceeding 7 feet in height above shelter deck, two situated at each end of the compartment. Compartments over 50 feet long must have additional ventilators of same dimensions or efficient fans.

(a) *Third-deck ventilators.*—When it is desired to carry animals upon the third deck a special permit must be obtained from the inspector of the

port. The vessel must be fitted as hereinbefore specified, lighted with electric lights, and properly ventilated. One set of ventilators should be trimmed to the wind, and another set in the opposite direction. They must be tested previous to issuance of permit and kept in easy working order.

(b) *Light.*—Suitable arrangements must be made to provide at all times sufficient light for the proper tending of all animals.

(c) *Engine-room.*—No animals should be loaded along the alleyways by engine-room unless the sides of said engine-room are covered by 1½-inch grooved and tongued lumber, making a 3-inch air space.

(d) *Ventilation for horses.*—When horses are carried under decks, canvas bags of size of ventilator, provided with iron rings at the bottom, shall be attached to the down-take of fresh-air ventilators, and reach to within 18 inches of the deck underfoot.

HATCHES.

7. *Animals and feed on hatches.*—No cattle or sheep shall be loaded upon hatches on decks above animals nor upon third-deck hatches when animals are carried upon such deck, nor shall any merchandise, freight, or food for animals be loaded upon said hatches, but said hatches shall at all times be kept clear.

In loading animals on upper decks four of the largest hatches shall be kept free of animals—one hatch forward, one aft, and two amidships—so that the intervening space will be proportioned as equally as possible. Cattle or sheep may be placed upon hatches in excess of this number. Horses shall not be allowed upon any hatches.

(a) *Height of hatches and vertical space.*—No cattle shall be loaded upon any hatch where the coamings exceed 18 inches in height in centre of hatch. There shall not be less than 6 feet vertical space between the beams overhead and the flooring placed on hatches under foot for horned cattle. Cattle without horns must be provided with 5 feet 6 inches clear vertical space between beams overhead and flooring underfoot.

FOOD AND WATER.

8. *Water.*—All vessels not provided with pipes for watering animals shall carry casks and hogsheads of not less than 400 gallons total capacity for each 100 head of cattle and horses, and an additional amount, in equal proportion, shall also be carried for sheep, and these shall be filled with fresh water before sailing and refilled as emptied. All water tanks for use of animals must be filled with good fresh water before sailing.

(a) *Condensers.*—Each vessel shall carry water-condensers which are in good working order and of sufficient capacity to provide 8 gallons of fresh cold water each twenty-four hours for each head of cattle, in addition to the amount required by other animals on board, and for other purposes.

(b) *Feed.*— Not more than two days' feed for the animals shall be allowed to be carried on deck. This shall be properly covered, and shall be the first feed used. All other feed shall be under hatches, and, so far as possible, shall be placed in the holds contiguous to the animals on board.

ATTENDANTS.

9. *Employment and character of attendants.* — The employment of all attendants shall be subject to the approval of the owners or agents of

steamships, and of the inspector of the port, and men so employed shall be reliable and signed as part of the ship's crew, and under the control of the captain of said vessel. They shall be furnished with well-lighted and well-ventilated quarters—as good as the same accommodations furnished the crew of the ship, and with bedding and table utensils. Experienced foremen shall be in charge of the animals, and not less than two-thirds of the attendants must be experienced men, who have made previous trips with stock. The shippers of export animals or their agents shall make affidavit concerning the character of the attendants.

(a) *Cattle attendants.*—There shall be one attendant for each thirty-five head of cattle upon steamers having water-pipes extending the entire length of both sides of compartments, and upon steamers not so fitted there shall be one attendant to each twenty-five head of cattle shipped.

(b) *Pumping water by hand.*—There shall also be additional help furnished by the captain of the vessel when water has to be pumped by hand.

(c) *Sheep attendants.*—There shall be one man in charge of each 150 sheep during the winter season (October 1 to April 1), and one to each 200 sheep during the summer season.

(d) *Horse attendants.*—For horses there shall be one attendant to each twenty-two head.

HEAD ROPES.

10. *Size and kind.*—Cattle shall be tied with $\frac{3}{4}$-inch rope, which shall not be used more than once, and must be either manila, sisal, or jute.

(a) *Head ropes seized.*—All head ropes returned to the United States shall be immediately seized and destroyed by the inspectors.

(b) *Halters, blankets, &c., disinfected.* — All halters, blankets, stable utensils, feed bags, and feed troughs, if returned to this country, must be disinfected under supervision of inspector of the port, unless an affidavit is furnished by the captain of the vessel that the same have been disinfected, describing the manner of disinfection, or by the proper official at the port where the animals are unloaded.

FALSE DECKS.

11. *Cleaning of false decks.*—False decks upon which cattle are loaded must be removed, and the manure and dirt cleaned from underneath before receiving another load of cattle.

INSPECTING, TAGGING, AND REST.

12. *Rest for cattle and sheep.*—No vessel shall be permitted to take on board any cattle or sheep unless the same have been allowed at least twelve hours' actual rest in the yards at the port of embarkation before the vessel sails, nor until the loading of the other cargo has been completed.

(a) *Inspection during daylight.*—All animals must remain a sufficient length of time in stables or yards during daylight at the port of embarkation before the vessel sails, for the purpose of inspection and tagging.

(b) *Rest for horses.*—No vessel shall be permitted to take on board any horses having been shipped over 500 miles, unless the same have been allowed at least eighteen hours' actual rest in the stable or stables designated by the inspector for export horses at the port of embarkation, before the vessel sails. Horses shipped less than 500 miles shall remain in such stables or yards as the inspector may designate not less than six hours for

the purpose of inspection and rest. Horses shall not be placed upon steamers until the loading of the other cargo has been completed.

DEFECTIVE FITTINGS.

13. *Replacing defective fittings.*—The inspector may, in case he finds that any of the fittings are worn, decayed, defective in construction, or appear to be unsound, require the same to be replaced before he authorises the clearance of the vessel.

LOADING.

Loading of animals and food.—The inspector, or one of his deputies, will supervise the loading of the animals, and see that they are properly stowed and tied; that a sufficient amount of good, wholesome food is properly stowed; and that all the requirements of these regulations have been complied with. In case the regulations have not been complied with, he will immediately notify the Chief of the Bureau.

INJURED ANIMALS.

15. *Injured animals slaughtered.*—Animals suffering from broken limbs or other serious injuries during the voyage shall be slaughtered by direction of the captain of the vessel.

These regulations will take effect on and after November 1, 1899.

JAMES WILSON, *Secretary.*

ABSTRACTS FROM REMARKS ON THE BACTERIOLOGICAL EXAMINATION OF POTABLE WATERS FROM THE PUBLIC HEALTH POINT OF VIEW.[1]

BY A. C. HOUSTON, M.B., D.SC., LONDON.

DURING the last ten years bacteriology has made rapid strides, but it cannot be said that progress has been swift in all directions. For example, the bacteriological examination of sewage in relation to the detection of dangerous pollution of potable waters with excremental matters is a subject which would still seem to offer to the patient worker an endless field for useful research.

I.—THE BACTERIOSCOPIC EXAMINATION OF WATERS.

An enormous amount of work has been carried out by numerous and accurate observers on this subject. Their investigations have been largely directed towards determining the bacterial flora of waters of diverse sort. That the results that have been accumulated in this direction are of value no one is likely to deny. Owing, however, to the almost insuperable difficulties of recognising microbes from their descriptions, even when these are accurate and complete, fresh workers unable to classify or identify the bacteria met with in their "water cultivations," either give them new names or are content to remain in ignorance of their identity, and merely to register the total number of micro-organisms of all sorts present in a sample. The number of "water bacteria" now described is quite remarkable, yet no one who has devoted any serious attention to the subject

[1] From the *Medical Journal*, 21st December 1901.

doubts for a moment that a large number of them belong to the same species. The inability to identify the different kinds of bacteria in water has of recent years shown itself in the direction of endeavouring to place the microbes met with in "water cultivations" under one or other of a number of separate and fairly well-recognised groups, for example, B. proteus (and allied forms), B. mesentericus (and its allies), fluorescent bacteria (liquefying and non-liquefying), B. subtilis (and its varieties), &c. Although this is to some extent a confession of ignorance, it is nevertheless of considerable practical value. Again, other authorities seek to classify water bacteria in unnamed groups according to the sum of their morphological and biological characters, being guided by factors whether they are chromogenic or non-chromogenic, liquefying or non-liquefying, sporing or non-sporing, long or short, rod-like or round in shape, motile or non-motile; whether they clot or do not clot milk, produce acid or alkali, gas or no gas, indol or no indol, and so on. From the public health point of view these records are perhaps of secondary importance, although on purely scientific grounds they may be of considerable interest. Thus it is of advantage to possess data, even if they be of a crude and imperfect kind, enabling different workers to compare approximately the bacterial flora of waters of diverse sort. But what the student of hygiene really wants is not so much a knowledge of the microbes proper (peculiar as it were) to water, but rather information regarding those bacteria which are to be thought of as of adventitious and possibly of dangerous sort. In this direction our knowledge is far from complete. During 1898 and 1899 I devoted a large amount of attention to this subject, in connection with the study of the bacterial treatment of London crude sewage at Barking and Crossness. These results have been published, but it is important to place some of them again on record in their relation to the bacterioscopic examination of potable waters, and in order to draw attention to certain matters hitherto neglected by bacteriologists.

II.—SEWAGE IN RELATION TO THE POLLUTION OF POTABLE WATERS.

Beyond question the most dangerous and most common source of the pollution of potable water is sewage. Yet our knowledge of the bacteria either proper to sewage or peculiarly abundant therein, and also the relative abundance of such microbes in sewage, is of an imperfect kind. It is true that much stress has been laid, and rightly so, on the presence of B. coli as an indication of objectionable contamination. But around this very question a great controversy has been waged, and it is still attracting the serious attention of many workers.

There can be no doubt that the failure to recognise the significance of the relative abundance of microbes of one or another sort in substances on the one hand to be thought of as pure and on the other hand as obviously polluted, is largely responsible for this state of things. To emphasise this point it will not be amiss to borrow from the experience of the chemist. All natural waters contain some organic matter, but in pure waters the amount is so small in relation to the gross amount found in foul substances such as sewage as to be negligible. The chemist does not condemn a water because it contains organic matter, but because it contains organic matter in undue amount. The knowledge of the chemist has been reached, not only by a consideration of the facts revealed by multiple analysis of

natural waters of diverse sort, but also by the examination of the substance most to be dreaded in relation to the pollution of water supplies—namely, sewage.

It is true that the position of the chemist is not secure, for he is forced to admit that, as far as we know, organic matter *per se* is harmless. And all his standards of potability are seemingly based on an assumed relationship which may or may not exist between the amount of organic matter and the number and character of the bacteria likely to be associated with such organic matter. But it is not the fault but rather the misfortune of the chemist that there are factors outside the scope of his subject which limit the usefulness of his analysis. From the logical point of view the history of the chemical analysis of potable waters is an object lesson to the bacteriologist. In a word, all chemical statements are based on a correct appreciation of the value of relative proportion. In the language of the bacteriologist this means the determination not only of the mere presence, but also of the relative abundance of microbes of one or another sort in substances of widely different character. This aspect of the question is one which has hitherto been neglected by bacteriologists. Strictly speaking, no one unacquainted with the kinds of bacteria (and approximately the relative abundance of each species as well as the total number) in air, soil, and sewage, can hope to fully understand the bacteriology of water supply. This is a counsel of perfection, but at least from the public health point of view it might be insisted upon that as a basis for the condemnation of a water supply contaminated with objectionable sewage microbes, some evidence should be forthcoming of the relative abundance of the same bacteria in raw sewage. It is, to say the least of it, most remarkable that this view of the subject has in the past seemingly escaped the serious attention of bacteriologists.

(*a*) *B. Coli.*

It has been asserted that the question of the significance of B. coli in water as implying pollution of objectionable nature has given rise to much controversy.

Thus those hostile to the value of this test insist that B. coli is abundant everywhere, that it multiplies outside the animal body, that it is associated with vegetable as well as animal organic matter, and that it is present in the intestinal tract not only of human beings but nearly all animals.

Against these views, which are largely conjectural in character, many arguments may be urged. For example, if B. coli is abundant everywhere one might expect to find it habitually and in large numbers in soils, since the earth is the last resting place of micro-organic life. But I have shown that it is absent (or relatively so) from many virgin soils and the "washings" therefrom. Again, if it multiplies outside the animal body under favourable conditions, there is every reason to suppose that it declines in number or perishes under unsuitable circumstances. As regards its association with vegetable organic matter, I have found it to be absent (or relatively so) from virgin peaty soils and in their "washings." It cannot be denied that B. coli is present in the evacuations of many animals, but we have yet to learn that the excreta of animals are altogether harmless to man.

To many the difficulty is ever present of determining whether the microbes met with in their cultures should or should not be classed as B. coli. And the problem is one not easily answered, as it involves the con-

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sideration of questions open to much controversy. Are we, for example, to go by the original descriptions of B. coli? But these are fragmentary and incomplete. Or by later descriptions founded on the study of certain cultures of B. coli which have found their way into one or another laboratory, and which are either believed to be true descendants of the original stock, or else the progeny of strains of B. coli in the first place isolated by bacteriologists of repute? But even these more or less accredited cultures of B. coli would seem to differ from each other to some extent, and it is difficult to believe that a microbe undergoes no change in its morphological and biological characters when subcultured year after year, and kept under artificial laboratory conditions. Lastly, we may take note of all these things, but supplement our knowledge with the careful study of the coli-like microbes met with in cultures made from the dejecta of human beings and animals, and from crude sewage.

Some bacteriologists take an extreme view, and refuse to accept any microbe as B. coli (or even as akin to B. coli) unless it responds to all of a number of positive tests, and does so moreover within a specified and quite arbitrary period. Thus, for example, they would reject a microbe otherwise like B. coli if it showed a delayed "clotting" power in milk culture, or a tardy ability to form indol in broth cultivations.

Assuming that the ancestors of such a micro-organism previously possessed these positive characters in normal degree, this would seem almost equivalent to considering that a man who had become short-sighted or slightly deaf could not any longer be regarded as belonging to the human species. It is well to remember that microbes of the above sort are very numerous in crude sewage, and, especially as regards indicating recent pollution, some of them may be of greater importance than the ideal B. coli of those who drive matters to an extremity. Some of the coli-like microbes of sewage clot milk in twenty-four hours, others in forty-eight hours or in seventy-two hours, or even later. As regards indol, this may be produced in three days or less, or may take five days or longer. Again sewage microbes seemingly indistinguishable from B. coli morphologically and in their growth in gelatine and agar cultures, may produce acid in milk culture without clotting it, and fail to respond to the indol test in broth cultivation even after a week's incubation or longer. Again, an indol-producing microbe may give rise to little or no visible change in litmus milk culture or a micro-organism producing acid clotting of milk may yield a negative result as regards indol formation. Indeed, in rapid or slow response to positive tests, or in lack of ability to respond to one or many of them, these coli-like microbes of sewage seem to present every possible variation.

Of course it is possible to go to the other extreme and consider microbes as allies of B. coli, which have really no kinship to the B. coli of the intestinal tract. While admitting that some of these microbes may be of as great or even greater importance than B. coli, they perhaps ought to be placed in a separate group. Of microbes isolated from crude sewage indistinguishable from B. coli in gelatine plate cultivations, the great majority, in my experience, correspond to the following brief description:—

(*a.*) Small motile rods occurring singly, in couples, or as short chains (Gram's stain negative, no spore formation).

(*b.*) Produce "gas" in gelatine "shake" culture in twenty-four hours at 20° C. (no liquefaction).

(*c.*) Produce abundant diffuse cloudiness in broth cultures in twenty-four hours at 37° C.

(*d.*) Produce acidity in litmus milk cultures in twenty-four to seventy-two hours at 37° C.

A considerable proportion of these microbes produce good clotting of milk in twenty-four to seventy-two hours at 37° C., and indol in broth culture within five days at 37° C.; but failure in these respects should, I think, not be regarded as proving absence of kinship to B. coli. However this may be, the fact remains that $\frac{1}{10000}$ to $\frac{1}{100000}$ c.cm. of crude sewage contains microbes which are either indistinguishable from B. coli or seemingly closely akin to B. coli, and that 1 c.cm. or more of at all events pure water does not contain micro-organisms of comparable sort.

By adopting a reasonable attitude in this matter, and by paying some attention to the hitherto neglected question of relative abundance, it becomes possible to avoid points possibly open to serious controversy, and yet retain a test of great practical utility and remarkable delicacy.

(*b.*)—*B. Enteritidis Sporogenes* (*Klein*).

In the preceding paragraphs I have endeavoured to show as regards B. coli the real importance to the bacteriologist of the question of relative abundance. But it is obvious that the same principle may be applied, although not necessarily with an equal measure of success, to many other microbes. For example, there is the B. enteritidis sporogenes test, the value of which can only be appreciated by a consideration of the relative proportion of this organism in substances of widely different sort.

Those hostile to the test have asserted that B. enteritidis sporogenes is not causally related to acute diarrhœa in human beings, that it is not always pathogenic even to animals, that there are other microbes which produce a similar transformation in milk cultures, and finally that as it is abundant everywhere in nature its presence in a water is of little or no significance.

Avoiding as far as possible facts the interpretation of which may be open to controversy, it is at the least certain that B. enteritidis sporogenes (in culture) may be, and commonly is, extremely virulent to guinea-pigs, and further that there is strong evidence that this anaërobe has been intimately associated with certain epidemics of acute diarrhœa in the human subject. As regards other microbes producing a similar transformation in milk culture, it is by no means easy to determine whether they are of different species or whether we are dealing with aberrant and non-pathogenic strains of the B. enteritidis sporogenes itself. This question, although of considerable scientific interest, is of minor importance from the point of view of the bacterioscopic testing of potable waters. The change in anaërobic milk culture which we are in the habit of ascribing to B. enteritidis sporogenes is a most characteristic one, and in my experience always points to pollution, although not necessarily of recent sort. Even if such a culture were found to be non-pathogenic it might lessen but would not destroy my belief that objectionable pollution was indicated. Indeed, in my experience, if a substance (for example, soil or sewage) produces in certain amount the "enteritidis change" in milk minus virulence of culture, it is only necessary in most cases to add the same substance to milk in greater quantity to obtain the same result plus extreme virulence. Whether

this is due to the virulent enteritidis sporogenes being accompanied and sometimes superseded by either aberrant and non-pathogenic strains of B. enteritidis sporogenes or by anaërobes of separate species matters very little so far as the test as a test is concerned.

As regards the alleged universal distribution of B. enteritidis sporogenes all sporing microbes are apt to have a wide distribution, and particularly it is likely to be the case with sporing anaërobes. B. enteritidis sporogenes is peculiarly abundant in excremental matters, and as these substances are widespread, it need excite no surprise if Klein's microbe be found largely diffused in nature. That it should persist and remain as a record of past pollution is only what might be anticipated in the case of a sporing anaërobe; but it is a little difficult to see why all this should be considered a fatal objection to the use of the B. enteritidis sporogenes test in the bacterioscopic examination of potable waters. If B. enteritidis sporogenes were equally abundant in pure and impure substances—for example, in virgin soil as compared with cultivated and polluted soil, and in pure water as contrasted with sewage-polluted streams—the test would indeed be one of little or no value; but when the relative abundance of this microbe in substance of pure and impure sort is taken into consideration, the practical value of the test becomes at once apparent. For example, in polluted and cultivated soils the number of spores of B. enteritidis is usually 1000 to 10,000 per gram, whereas in virgin soil it may be absent from 10 or more milligrams. Further, the "washings" of polluted soil contain B. enteritidis sporogenes in abundance, while in the "washings" of virgin soil it is absent or relatively so. As regards pure water, I have failed on numerous occasions to demonstrate its presence in the bacterial contents of 200 c.cm. or more; yet in crude sewage it is habitually present in so minute a quantity as 0·01 to 0·001 c.cm.

There is one objection to the test—namely, that it does not prove that the pollution was necessarily recent. It is worth noting that this fact was pointed out in the first place not by those hostile to the test, but by those whose practical experience had led them to adopt it. Moreover, this objection may in certain cases resolve itself into a positive advantage. For example, in cases where we seek to ascertain whether a substance showing no evidence by other tests of recent pollution, has or has not been contaminated at some time in the past.

In brief summary, it is to be noted that if so small an amount as 0·01 to 0·001 c.cm. of crude sewage is added to a sterile milk tube, the tube heated to 80° C. for ten minutes, and then incubated in a Buchner's tube at 37° C., a highly characteristic change occurs in the milk culture known as the "enteritidis change." Polluted soils and their "washings" effect a similar transformation in milk cultures when added thereto in minimal quantity. Virgin soils and their "washings" give rise to no such change, or only do so when added in relatively gross amount. Lastly, the bacterial contents of 100 c.cm. or more of at all events some pure waters yield in milk cultures a totally negative result as regards this "enteritidis change."

Whether B. enteritidis sporogenes is or is not causally related to acute diarrhœa in the human subject, whether the cultures showing the "enteritidis change" are or are not virulent in animals; whether or not aberrant and non-pathogenic strains of B. enteritidis sporogenes or other anaërobes of different species can produce a similar change in milk and accompany or even sometimes surpass in number the true B. enteritidis sporogenes,

matters very little so far as the test, *as a test*, is concerned. All responsible workers will admit that Klein's researches have placed in their hands a test ("the enteritidis change" in milk culture) of singular value in the bacterioscopic examination of potable waters.

It has been said that B. enteritidis is present in 0·01 to 0·001 c.cm. of crude sewage, and is absent from 200 c.cm. or more of, at all events, some pure waters. This distinction is so great that it is evident that even if we adopted a most lenient standard and considered one spore of B. enteritidis sporogenes permissible in 10 c.cm. of water, the ratio of water to sewage as regards B. enteritidis would still remain 1 in 1000 or 1 in 10,000 according to the strength of the sewage. But it is not sought to lay down any fixed standard, although the large number of examinations of samples of soil, sewage, and water that I have now made might possibly justify me in doing so.

(*c.*)—*Streptococci.*

The biological distinction between crude sewage and potable waters might with advantage be discussed at much greater length. For example, it may be pointed out that crude sewage harbours in great abundance virulent microbes belonging to the B. proteus class, and that pure waters are free (or relatively so) from micro-organisms of similar sort. But enough, perhaps, has been said to show that, as regards certain microbes, a biological distinction almost inconceivably great exists between crude sewage and pure water, and that it is quite unnecessary and most inadvisable to adopt bacteriological standards of stringent, and therefore controversial sort. The fact is that even if standards be adopted of so extremely moderate a nature as to disarm all hostile criticism, the bacteriological tests that I have mentioned greatly surpass in delicacy any tests of potability at present available to the chemist. If any one should entertain any doubt on this matter, the following statement may serve to carry conviction :—Each drop of crude sewage harbours about 5000 B. coli, from 5 to 50 spores of B. enteritidis sporogenes, and about 50 streptococci. Although I am here speaking of crude sewage, it may not be amiss to add that a single drop of the urine of a patient suffering from typhoid bacilluria may contain 1 million or more typhoid bacilli.

Conclusions.

In conclusion, the following points are worthy of note :—

1. That from the public health point of view knowledge is required, not so much as regards those microbes proper (peculiar, as it were) to pure water, but rather as regards those micro-organisms which are to be thought of as being of adventitious, and possibly of dangerous, sort.

2. That as sewage is the most common and dangerous source of the pollution of potable water, further knowledge is required of the bacteria characteristic of sewage.

3. That bacteriologists have hitherto almost entirely neglected the question of the relative abundance of micro-organisms of different sort in pure and impure substances—for example, water as compared with sewage, virgin soils as compared with polluted and cultivated soils, &c.

4. That attention to this question of relative abundance has a most important bearing on the bacterioscopic analysis of potable waters from the public health point of view, because it shows that the biological distinction between pure and impure substances (for example, water and sewage) is so

great as to be almost inconceivable, so great as to render the adoption of rigid and stringent bacteriological standards unnecessary and inadvisable, and so great, also, as to allow the bacteriologist to detect in a water the presence of objectionable polluting material in quantity so small as to be far beyond the reach of chemical analysis.

5. That streptococci are absent from 10 c.cm. (or more); B. coli from 1, 10, it may be 100 c.cm. (or more); and B. enteritidis sporogenes from 100 to 500 c.cm. (or more) of pure waters; that is, these microbes are altogether absent or relatively so from pure waters.

6. That streptococci, B. coli, and B. enteritidis sporogenes are commonly present in $\frac{1}{1000}$ c.cm., $\frac{1}{100000}$ c.cm., and in $\frac{1}{100}$ to $\frac{1}{1000}$ c.cm. respectively of crude sewage; that is, these microbes are present in crude sewage in great abundance.

7. That it is evident from these figures that there are tests available to the bacteriologist in the bacterioscopic examination of potable waters which far surpass in delicacy any known chemical tests.

8. That a stage may be reached in the pollution of water with sewage when the contaminating material is so small in relation to the bulk of water as to be inappreciable by chemical means, while yet yielding to bacteriological tests unequivocal evidence of gross pollution with microbes of intestinal origin. This is a matter which has passed the stage of controversy.

9. That the presence of streptococci are to be thought of as indicating extremely recent, and B. coli less recent, but still not remote, pollution of animal sort, but that the presence of B. enteritidis sporogenes cannot be considered to afford evidence of pollution bearing a necessary relation to the recent evacuations of animals.

10. That streptococci and B. coli are either altogether absent or present in sparse amount in virgin soils, and may be absent even from polluted soils, unless the contamination is of comparatively recent sort. In soils recently polluted with animal matters streptococci and B. coli are of course present in abundance. B. enteritidis sporogenes may be present even in seemingly virgin soils, but in sparse proportion compared with the large number found in cultivated and polluted soils.

11. That the presence of streptococci in any number in a water supply points not only to recent animal pollution, but also implies that the antecedent conditions—conditions intervening between the period of pollution of the water and the time of collection of the sample—could hardly have been of so unfavourable a character as to destroy the vitality of seemingly more hardy microbes—for example, the typhoid bacillus. Quite the same cannot be said for the B. coli test, since B. coli is a more hardy germ than B. typhosus.

12. That organic matter *per se* is, so far as we know, harmless; it is the bacteria apt to be associated with the organic matter that constitutes the element of danger.

13. That the amount of organic matter in a drop or even a few drops of sewage is so small as to be hardly appreciable on chemical analysis, and yet a like quantity of sewage can be shown by bacteriological tests to harbour objectionable germs in great abundance.

14. That it is not necessary to demonstrate in a polluted water supply the presence of definitely pathogenic microbes to prove that there is danger in drinking such water.

15. That it is sufficient to show that microbes indubitably of intestinal origin are present in a water to condemn that water, because it is beyond controversy that these micro-organisms are apt at any time to be accompanied by other bacteria which are clearly known to cause disease in human beings.

16. That the bacteriologist can show that between a pure water and a water contaminated even with minute traces of excremental matter there exists a biological difference not only of degree but of kind.

17. That under like conditions the chemist may fail to appreciate the pollution altogether, and most certainly can form no conception of its dangerous character.

18. That the chemist's methods of endeavouring to ascertain the truth in the analysis of water are necessarily indirect ones, and all his standards of potability are based on an assumed relationship which may or may not exist between the amount of organic matter and the number and character of the associated bacteria.

19. That valuable as the chemical analysis of a water undoubtedly is, it ought in the future to occupy a secondary position, and the bacteriological examination take its place in judging the purity or otherwise of our water supplies.

20. That until these facts are recognised and acted upon progress in the prevention of waterborne disease must needs remain unsatisfactory.

ON HAIR IN THE EQUIDÆ.[1]

BY F. H. A. MARSHALL, B.A., F.R.S.E.

THE taxonomic value of hair has long been recognised. The different types of human hair have been made use of as a basis for classification of the varieties of man by Primer Bey[2] and many others, while Waldeyer[3] in his atlas has described briefly the hair characters of well-known members of the Mammalian orders. In the present paper it is proposed to deal with hair within the limits of a single family,—that of the Equidæ—and to describe certain peculiarities in the hairs of members of that group, which the author is of opinion are probably of specific value. But before dealing with the hair characters by which the species may be distinguished from one another, something must be said about those of the group as a whole.

The characters by which hairs of different animals can be distinguished from one another, apart from their length, shape, and colour, the latter being of little or no taxonomic value, are the nature of the cuticle, the extent of development of the medulla in different parts of the hair, the relative thickness of the medulla, and the arrangement of the pigment in the cortex. The cuticle presents comparatively slight modifications, and consequently the characters of this layer are not of much value for taxonomic purposes. In the hairs of the different members of the Equidæ it is, so far as I have observed, almost identical, being smooth or only

[1] Abstract of a Paper read 17th June 1901 at a Meeting of the Royal Society of Edinburgh.

[2] Primer Bey, "Human Hair as a Race Character," *Jour. of Anthropological Institute*, vol. vi.

[3] Waldeyer, *Atlas des Menschlichen und Tierischen Haare*, &c., Lahr, 1882.

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slightly imbricate. In transverse sections it appears little more than a line bounding the cortex on the exterior.

The medulla, on the other hand, shows very great variability in different animals, and the accounts given of it by various writers differ widely from one another. Primer Bey, writing of human hair, describes three kinds of hair differing in this character, according as to whether there is a central canal devoid of medullary substance, a canal filled with medulla, or whether the hair is composed of cortical substance throughout. Reissner [1] refers to the partial absence of medullary substance in some animals, and its total absence in seals and some Chiroptera. Ridewood [2] in a recent paper draws attention to its absence in sloths, and quotes Welcher, who first noticed this fact. Poulton [3] states that the medulla is wanting in the slender unpigmented base and also in the "neck" region in the hairs of *Ornithorhynchus*. Henle,[4] who describes the medulla as a substance, consisting as a rule of two rows of cells whose nuclei are flattened transversely, says that this substance is quite absent in the finer hairs, and is not constant in the stronger ones, failing here and there. Other authorities may be quoted to show the variability of the medulla in different animals' hairs.

In all the equine hairs that I have examined, even in the very finest, the medulla is present, though its degree of development is somewhat variable. It is usually absent for a considerable distance, both from the point and from the base of the hair, and may have broken down in an unaccountable fashion in one or more places on the hair shaft. Moreover, it consists, at least in its thickest part, of certainly more than two rows of cells, the nuclei of which can be seen in suitably stained sections. The absence of the medulla at the base of the hair is accompanied in many cases by the absence of pigment in the cortex. This is well shown in the hairs of the Somali zebra, which will be described lower down. Such an absence is invariable in fully grown hairs. Hairs which have not yet grown to their full length retain the medulla to a point much nearer the root. This shows that with the growth of the hair the medulla tends to disappear towards the root. The manner of its disappearance is an open question. Mertsching,[5] after referring to certain statements by Kölliker that the frequent absence of the medulla in coloured human head hairs, and its almost regular occurrence in white head hairs, says that this points to the inference that the formation of the medulla is connected with the turning grey of the hair. This, however, cannot apply to equine hairs. But the colour of a hair to the naked eye is affected by the breaking down of the medulla, such hairs appearing considerably duller and darker. Thus light brown hairs become dull brown.

Speaking generally, then, equine hairs may be said to be characterised by the invariable presence of the medulla to a greater or less degree of development, and by the tendency of the medulla to disappear at irregular intervals, leaving air spaces of all sizes. This latter characteristic appears in Waldeyer's figure of horse hair, but not in his figures of the hairs of other Mammalia.

[1] Reissner, *Beiträge zur Kentniss der Haare*, Breslau, 1854.
[2] Ridewood, "On the Structure of the Hairs of *Mylodon listai*," *Q.J.M.S.*, vol. xliv.
[3] Poulton, "The Structure of the Bill and Hairs of *Ornithorhynchus paradoxus*," *Q.J.M.S.*, vol. xxxvi.
[4] Henle, *Hand. der Eingeweidelehre*, Braunschweig, 1873.
[5] Mertsching, "Beiträge zur Histologie des Haares und Haarebalges," *Arch. f. Mikr. Anat.*, Bd. xxxi. 1888.

Another character by which the equine hairs may be distinguished from other hairs, and from hairs of other species in the genus, is the distribution and arrangement of pigment in the cortex. Nathusius[1] has called attention to the fact, which I have often observed, that in some species of the genus *Equus* the pigment granules on one side of the medulla may present a different coloration to those on the other side; in other words, that the hair may be striped longitudinally. This character, so far as I have observed, does not hold good for horse hairs, but it is very general in other members of the family. The hairs in such cases are coloured by at least two different sorts of pigment, which have blended unequally on the two sides of the hair. In this connection it is interesting to repeat for equine hairs some of Sorby's[2] experiments on human hairs. When brown hairs of the type in which longitudinal striping is common are dissolved in a strong solution of sulphuric acid, it is frequently found that one or more of the pigments goes into solution which is coloured, as do also the other constituents of the hairs, while another pigment sinks to the bottom undissolved. This result is similar to Sorby's for black human hair, which contains a quantity of brown or red pigment which colours on acid solution, the dominating black pigment, which causes the hairs to appear perfectly black, sinking to the bottom as a precipitate. This, however, I have not found to be the case with black horse hair, for when this is dissolved in strong acid, after the black pigment has sunk to the bottom, the acid solution remains perfectly clear and uncoloured. When white or nearly white horse or ass hairs are dissolved the solution is also clear, this result agreeing with Sorby's for white human hair. The study, however, of the different sorts of pigment, whether in equine or other hair, and the application of the spectroscope to the problems presented is the work of the chemist.

In discussing hair coloration it is well to remember that the tone of colour presented by the hairs collectively on the skin is often quite different to that of the individual hairs when viewed separately through the microscope. This must be due to the blending of the different shades of colour in the general effect. The colour of a hair is commonly supposed to depend on the presence or absence of the pigment granules of different shades in the cortex. This is, of course, largely the case. But there is often in addition a diffuse coloration throughout the cortex, and, as above remarked, the colour of a hair is affected not inconsiderably by the degree of development of the medulla and what is related to it, the presence or absence of air vacuoles in the medullary canal.

A few remarks must be made concerning the shape of equine hairs. Nathusius, in his investigations, made use of hairs from the shoulder region or from the side of the body, and remarks that in these, with the increasing thickness of the hair, the cross section becomes more oval and less circular in shape. Thus the most circular sections are those through the medullaless regions near the point and root. In another place,[3] Nathusius appears to apply this description to hairs in general. My own observations have shown

[1] Nathusius, "Über die taxionomische Bedeutung der Form und Farbung der Haare bei den Equiden," *Verhand. d. Deut. Zool. Gesellschaft auf der zweiten Jahresversammlung zu Berlin*, June 1892, Leipzig, 1892.

[2] Sorby, "On the Colouring Matters in Human Hair," *Journal of Anthrop. Inst.*, vol. viii.

[3] Nathusius—"Uber Haar-Formen und Farben von Equiden,"—*Landwirt-schaftliche Jahrbucher*, Bd. xxvi., 1897, Berlin.

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it to be very generally applicable to the shoulder and side hairs in the Equidæ, but this cannot be said for the hairs of the mane, sections through which are commonly circular throughout the entire length of the hair, the exceptions being, so far as I have seen, certain very long and fine mane hairs of horses, and the mane hairs of the mountain zebra. These are elliptical. The flattening, as is well known, is related closely to the tendency the hair has to curl. Thus, in animals with stiff upright manes we should expect to find a circular hair section.

Like Nathusius, whose investigations were almost entirely upon horse and ass hairs, I have employed hairs from the shoulder region. By simply mounting such hairs in balsam, many of the characters can be quite well made out. But I have also employed mane hairs, which, from their greater value for taxonomic purposes and the much greater ease in cutting them into transverse sections, are more useful for purposes of comparison. Cutting sections through hairs is always a matter of some difficulty, and not the least part of it is to contrive that the sections shall be transverse. Dr. Hepburn has been kind enough to show me the apparatus he has invented and employed for keeping the hairs stretched out during embedding. It consists of two small metal boxes open at their ends, and made to fit into each other. The hairs are stretched across the open end of one of the boxes, which on being fitted into the other one retains the hairs in position. The whole apparatus can then be embedded in paraffin, and the paraffin block containing the stretched hairs can be cut out of the metal box (since the ends are open) after solidifying. I have employed this apparatus for the shorter hairs, but for longer hairs it is just as easy to embed in an ordinary paper box, keeping the hairs stretched across by fastening their ends in holes in the paper. The hairs were cleared in xylol or turpentine before being embedded. I have found paraffin of a meting point of 58° C. the best for embedding in. The sections were cut with a Cambridge rocking microtome at a thickness of 10μ, cleared in xylol and mounted in Canada balsam.

The material employed has been largely provided by Professor Ewart, either from animals in his stud at Penycuik or from skins in his possession; but I have been able to confirm some of my observations on hairs obtained from animals in the gardens of the Zoological Society of London. In work of this sort it is desirable, before setting down certain characters as those of the species, to confirm one's observations in as many individuals as possible. Where only one individual of a species is studied it is easy to fall into the error of regarding certain characteristics as belonging to the species which are really only individual peculiarities. It is also well to remember that it by no means necessarily follows that because hairs possess certain general characters which it is usual to find in the members of a particular family, such as that of the Equidæ, that they must belong to an animal which is a member of that family. On the other hand, it is natural to suppose that the causes which operate in determining a particular form of hair in the members of one family should operate and bring about similar results in the members of a quite different family. It is acknowledged that those who maintained that an extinct animal could be restored by an examination of a single bone went a great deal too far. And so, in the absence of other evidence, to attempt to assign an animal to its genus on the strength of the characters of some of its hairs, would be equally unreasonable. An examination of the hairs of the new mammal recently

discovered by Sir Harry Johnston, K.C.B., pointed to the conclusion that the animal belonged to the genus *Equus*. The history of this discovery is now well known. Pieces of skin were first obtained, but not a complete skin, nor had the animal been seen alive. There was, however, other evidence besides that derived from the shape and structure of the hairs that the animal was equine. The skin was striped in a manner very suggestive of a zebra. On the strength of the evidence, Dr. Sclater named the animal *Equus Johnstoni*. The resemblance between these hairs and the shoulder hairs in the Equidæ was shown by Dr. Ridewood at a meeting of the Zoological Society,[1] and I myself can testify that whereas they do not resemble the hairs of any particular species of zebra especially, they do not differ more from the hairs of any such species than the species of zebras in their hair characters differ from one another.[2] Sir Harry Johnston has more recently obtained a complete skin and two skulls of the animal, and these show that it is related to the extinct *Hellado-therium*, and may perhaps be referred to that genus.[3] Dr. Ridewood, at a more recent meeting of the Zoological Society, exhibited microscopic preparations of the hairs of this animal and also of giraffe and antelope hairs, and pointed out that the hairs of the so-called *Equus Johnstoni*, while they differed from those of antelopes, resembled those of the giraffe and also those of the zebra.

The genus *Equus* contains some ten or more species, including two species of horses, three or four of asses, and a doubtful number of species of zebras. Three species of zebras are, however, well defined, namely, the Burchell's zebra (*Equus Burchelli*), the common or mountain zebra (*Equus zebra*), and the Somali or Grevy's zebra (*Equus Grevyi*). Some account will now be given of the hairs of these zebras, after which the hairs of the horse will be referred to, and the paper will be concluded by a description of the hairs of certain zebra-horse hybrids and a reference to the telegony hypothesis.

Equus Burchelli.

In this, as in other zebras, the hairs are generally of stouter form than in the horse or ass, and the medulla in the case of the shoulder hairs at any rate is relatively thicker in the former than in the latter. A longitudinal streak, formed by pigment darker coloured than that colouring the rest of the cortex, may not infrequently be observed, so that the hair may appear, if mounted in a suitable position, differently coloured on one side of the cortex to what it is on the other. The medulla in many hairs is broken down in places and may be absent from the root for a distance as much as a quarter the length of the hair. The latter may reach 20 mm. Sections through the hairs of the mane which is upright are circular. The line of demarcation between the cortex and medulla is irregular. The pigment is seen to be distributed much more thickly in that part of the cortex nearest the medulla than towards the periphery of the hair. The hairs here

[1] P. Z. S., 1901.

[2] The Okapi's hairs, which I examined, are from a bandolier made from the skin from one of the legs of the animal (*vide* Sclater, P.Z.S., 1901). They are about 5 mm. in length, or about the length of the shoulder and side hairs in the Somali and Penrice's zebra, from both of which they differ in shape, tapering to a point much more gradually. In the relative development of the medulla and cortex they closely resemble equine hairs, differing entirely from the hairs of antelopes, goats, and deer.

[3] Since the above was written Professor Lankester has named this animal, which is called the Okapi, *Ocapia Johnstoni*, Dr. Sclater having already supplied the specific name.

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described are those of the Chapman's variety of the *Equus Burchelli.* This animal is regarded by Nathusius as a distinct species, as is also *Equus Böhmi.*

Equus quagga.

This animal, although undoubtedly a member of the Burchell's group of zebras, is commonly regarded as a distinct species. The hair characters are closely similar to those of the Chapman's zebra, but those of the side of the body tend to be longer and may reach 25 mm. in length ; that is longer than the same hairs in any of the other zebras.

Equus zebra.

The shoulder hairs of the common or mountain zebra are not strikingly different to those of the Burchell's. The length is about the same.

A longitudinal streak is commonly very distinct, and is often brought about by the presence of pigment on one side of the hair but not on the other. The medulla is wanting in the tip and root regions as in the Burchell zebra hairs. The hairs, including those of the mane, undergo a marked flattening. This is remarkable, seeing that sections through mane hairs, not only of the Burchell's but also of the Somali zebra, are nearly, if not quite circular, even those through the hair in the middle of its length where the degree of flattening is often greatest. The sections also show that the pigment is not specially aggregated towards the medulla, but is spread fairly evenly through the cortex, except in cases where the hair is longitudinally striped by pigment being present in much greater quantity on one side of the medulla than on the other. The line of demarcation between the cortex and medulla is parallel to the surface of the hair and not irregular as in the Burchell's zebra.

Equus Grevyi.

A study of the hairs of the Somali or Grevy's zebra leads to the conclusion that this zebra stands apart from all the others. Nathusius has commented on the extreme shortness of the hairs of the side of the body, their average length being about 5 mm.

These measurements show considerable divergence from those of the other zebra hairs, and what is more, they are remarkably constant, being approximately the same for any fully grown hair drawn from the side of the body. The medulla is absent for some distance from the root, and where it makes its appearance is accompanied by a sudden thickening of the hair. Thus the hairs have long medullaless stalks. The pigment, which is thick in the greater part of the hair's length, becomes thinner passing along the stalk, until near the root it is almost completely absent. It is apparently disintegrated in various places in the hair shaft. The most obvious character of these hairs is their remarkably short and stout form, being, relative to their length, much thicker than those of the other zebras, but actually very slightly thinner than those of the Burchell zebra, that is, taking the measurements in the thickest part of the hair in each case. Sections through the hairs of the mane, like those of the Burchell's zebra, are circular almost throughout. The line of demarcation between the cortex and medulla is also almost regularly circular. The pigment is seen to be distributed pretty equally throughout the cortex, but has a slight tendency

in places to be thicker nearest to the medulla and thinner towards the cuticle.

The extreme shortness of the hairs on the side of the body can hardly be ascribed to want of vigour caused by the environment in which this zebra lives, for, as Nathusius points out, the hairs of the Somali ass, which lives under the same climatic conditions, are longer and better developed than those of any of the other wild asses.

Equus caballus.

The hairs of the horse, as might naturally be expected in a domesticated animal of which there are very numerous breeds, show extreme variability, so that it is practically impossible to state any characters which are applicable to all varieties of the species. The section figured, which is through a mane hair of Professor Ewart's "Circus Girl," the foal of a skewbald Iceland pony by a Shetland pony, is fairly typical. The characters there seen, such as the fine granular appearance of the evenly distributed pigment, the clear and regular line of demarcation between cortex and medulla, and the relatively narrow cortical region, are very common in transverse sections of mane hairs of horses. The shoulder hairs, speaking broadly, show a weaker development of the medulla and a thicker cortex than in any zebra hairs. Of course the length, breadth, and fineness of horse hairs are especially variable and depend largely on the breed.

Nathusius, who has but briefly described zebra hairs, has devoted considerable space to horse hairs, referring to the characteristics of some of the breeds, so it is unnecessary to say anything on this subject here. Reference must, however, be made to a character upon which Nathusius, in his earlier papers at any rate, appears to lay considerable stress. I refer to the longitudinal striping so common in zebra and ass hairs. For some time he regarded this character as absent in horse hairs. Subsequently, however, he discovered longitudinal striping in hairs of certain ponies of mixed breeds imported from Russia. Although I have never observed such longitudinal striation in horse hairs, I know of no reason why it should not sometimes occur, especially in view of the fact that there is considerable evidence, as Professor Ewart [1] has shown, that the horse is descended from a striped zebra-like ancestor, and that this longitudinal striation is quite as well marked in the hairs of the asses, which are often supposed to have branched off from the ancestral equine stock, before the body striping was acquired in the Equidæ. It must, however, be doubtful how much stress should be laid upon such a character as variation in the degree of blending and arrangement of pigment, seeing that pigment in the other groups of the animal kingdom is known to be especially variable and easily influenced by the environment.

Asses.

Ass hairs are very fully dealt with by Nathusius in the two papers already quoted. It need only be mentioned here that longitudinal striping is very common in the shoulder hairs, and is sometimes seen also in those of the mane, and that the hairs show a marked degree of flattening, especially those of the Somali ass.

[1] Ewart, *The Penycuik Experiments.* London, 1899.

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Zebra-Horse Hybrids.[1]

The hairs of several of Professor Ewart's zebra-horse hybrids have been examined and sections cut. Seeing that the dams of these animals belong to different breeds, it might at first be expected that we should find quite as much diversity in the character of the hybrid hairs as in those of the dams. Such, however, is not the case, for the hairs of the hybrids are for the most part constant in shape and in the relative development of the medulla and cortex. The measurements, taken as before, of the shoulder hairs of the hybrid "Norette," whose dam was a Shetland pony, are not widely different from those of the sire, the Burchell's zebra.

They point to the conclusion that in the transmission of the character of the hair the Burchell's zebra is prepotent over the horse.

In some cases, however, the hybrid hairs do not resemble those of the sire any more than those of the dam, but this is not because they depart from the hybrid type, but because the hairs of the dam happen to be not dissimilar to zebra hairs. It has been mentioned that horse hairs, owing to the large number of breeds of horses are very variable, and so it is not to be wondered at that in some cases sections through horse hairs should resemble sections through zebra hairs. This is the case with sections taken through the hair of the mane of Professor Ewart's Clydesdale mare, "Lady Douglas," the mane hairs of whose hybrid offspring "Brenda" are if anything more like those of the dam than those of the sire "Matopo." A more typical case is that of the hybrid "Sir John." Here the dam was a skewbald Iceland pony, "Tundra," and the sire the Burchell's zebra. Sections through the mane hairs of "Tundra" are identical in appearance with sections through hairs of "Circus Girl," which are figured. Sections through the hairs of the hybrid offspring "Sir John," on the other hand, are in no way suggestive of those from the dam, but closely resemble those of the hybrids "Black Agnes" and "Brenda," one of which is figured. Professor Ewart has given reasons for the conclusion that of the existing species of zebras the Somali zebra approaches nearest to the ancestral type. He has also shown that the markings of the hybrids resemble the markings of the Somali zebra much more closely than those of the Burchell's zebra, and this resemblance he has ascribed to reversion. Now it cannot be said that the shoulder hairs of the hybrids, either in their shape, length, which is rather variable, or in the arrangement of the pigment, are at all suggestive of the same hairs in the Somali zebra. When, however, we compare the hairs of the mane the case is quite different. A section through a hair of the mane of a hybrid, such as the one figured, which is through such a hair in "Brenda," which in the mane hair characters is quite typical of the hybrids, shows a fairly even distribution of pigment, and a circular line of demarcation between cortex and medulla, which are also what we find in a mane hair section from the Somali zebra. There is very little of that tendency of the pigment to become more thickly distributed towards the interior of the cortex, such as I have found in all sections through mane hairs of the Burchell's zebra. This is a curious result, and may, perhaps, like the peculiarities of the striping, be ascribed to reversion to the more ancestral type.

The Telegony Hypothesis.

Nathusius suggested that if the telegony hypothesis, or the hypothesis

[1] *Vide* Ewart, *The Penycuik Experiments*, London, 1899; and *Guide to Zebra-Hybrids*, Edinburgh, 1900.

that subsequent offspring are infected by a previous sire, be correct, we might expect to find evidence of it in the character of the hairs of the subsequent offspring. We have such a subsequent offspring in Professor Ewart's "Circus Girl." In 1897 the dam "Tundra" gave birth to a hybrid, "Hecla." In 1898 the subsequent foal "Circus Girl" was born, the sire being a bay Shetland pony. Just as "Circus Girl," both in make and colour, closely resembles her mother, so the hairs of the two animals are almost identical in character, and sections through the hairs of the manes are quite indistinguishable. There is nothing whatever suggestive of the Burchell's zebra "Matopo," which was the previous sire. The same remark is equally applicable, so far as I have seen, to the other subsequent foals in respect of their hair characters.

I must express my indebtedness to Professor Ewart for providing the greater part of the material used, and for assistance in various other ways. To Mr. Beddart, Prosector of the Zoological Society, I am indebted for what other material has been employed. In conclusion, I have great pleasure in thanking Sir Thomas Gibson Carmichael, Bart., for his very generous support.

Postscript, July 31st.—Since writing the above, Professor Ewart has been good enough to obtain for me, through the kindness of Mr. Oldfield Thomas, some mane and shoulder hairs from a zebra skin recently brought home from Angola by Mr. W. Penrice. Mr. Thomas[1] describes the skin as possessing "the deeper and more essential characters of the *Equus zebra*, such as the forward slope of the median dorsal hairs, the presence of a 'gridiron pattern' on the rump," &c., but differing from it "so much in other details that it clearly cannot be assigned to the typical form of that species." Mr. Thomas adds that since it is isolated geographically from *E. zebra*, which is only known from South Africa, and differs from it in so many respects, in the absence of evidence of the existence of intermediate forms, it must be regarded as a distinct species, which he calls *Equus Penricei*.

The characters of this animal's skin are briefly described by Mr. Thomas.[1] I find that the individual hairs from the region of the shoulder resemble closely those of the Somali zebra (*E. Grevyi*), which, according to Mr. Thomas Penrice's zebra also resembles in "the equal striping of the body, the short, close fur, and the buffy tone of the light stripes." In length the shoulder hairs are scarcely more than those of the Somali zebra, being usually a little over 5 mm. They are appreciably flattened in the middle, agreeing in this respect with most equine hairs. A longitudinal striping can be observed in some of the hairs. The medulla is not present for a considerable distance from the root, and where it arises the hair thickens out rapidly as with shoulder hairs from the Somali zebra. On the other hand, the medulla extends almost to the hair's tip. Pigment of a lighter colour than that of the rest of the hair is present throughout the medullaless region in the coloured hairs. Transverse sections through the hairs of the mane present a circular outline. The pigment in the cortical region is evenly distributed between the cuticle on the one side and the medulla on the other. The line of demarcation between the cortex and medulla is extremely irregular instead of being parallel to the cuticle.

[1] Oldfield Thomas, "On *Equus Penricei*, a Representative of the Mountain Zebra discovered by Mr. W. Penrice in Angola," *Annals and Mag. of Nat. Hist.*, vol. vi., November 1900.

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THE NATIONAL VETERINARY BENEVOLENT AND MUTUAL DEFENCE SOCIETY.

THE Annual Meeting was held at the Grand Hotel, Aytown Street, Manchester, on Thursday, December 5th. George Morgan, Esquire, President, in the chair. Present:—Messrs. E. Faulkner, W. A. Taylor, Wm. Woods, J. B. Wolstenholme, J. S. Carter, J. H. Carter, R. C. Trigger, J. S. Scriven, F. W. Somers, J. Howard, E. S. Gubbin, and the Secretary.

Minutes of the last Annual Meeting were taken as read and confirmed, the same having been printed.

Letters of apology for non-attendance were received from Messrs. W. O. Williams, A. Lawson, A. J. MacCallum, H. J. Dawes, R. S. Reynolds, A. L. Butters, W. Carless, J. E. Kitchen, F. W. Wragg, J. Abson, and J. M'Kinna.

Letter read from Professor W. O. Williams acknowledging letter of condolence.

PRESIDENTIAL ADDRESS.

GEO. MORGAN, F.R.C.V.S.

Gentlemen,—As your President it devolves on me to say a few words to you at this our Annual Meeting, and it is with pleasure I congratulate you on the continued success of the Society.

If there is one thing more than another encouraging us to persevere in a good work, of which we have had the privilege of being among the pioneers, it is the satisfaction of knowing, whether successful or not, that we have done our best, and have sown good seed; and, although another may reap the harvest, it is only another illustration of what the good old book says—"One soweth and another reapeth."

This Society was, in the first instance, established for the mutual protection of its members against the attacks of litigious clients, who, in those days, were very fond, on the slightest pretence, to "have to go for" the veterinary surgeon, especially those who were new members of the profession, and not likely to have much ammunition in the shape of money to enable them to fight; and we all more or less know what a source of anxiety to a struggling member is a lawyer's letter threatening pains and penalties unless so and so be done within a certain stated period. There are some who from their first start can laugh these things to scorn, but they are few in number who can afford to set them at defiance, and fewer still who can fight single-handed, however just their cause. The combination for this purpose has done good work, for which I am very thankful. The surplus accruing from the subscriptions and sundry donations were put on one side, and formed the nucleus of the Benevolent Fund—a very necessary adjunct to the profession; for, no matter how we look at things, we will find that in every branch of business there are a certain number who go to the wall; sometimes this is entirely their own fault, in others a dark fatality seems to dodge their steps however careful they may be. Some men we have seen who have started able and full of hope, but who have failed in the race of life through misfortune, through mistakes, or through sickness, and come down with a crash, imploring the assistance of such a society as ours to aid them in their distress. And I am glad to say that any genuine appeal, having the least claim on our funds, has not been made in vain.

It was with pleasure that I heard of the "National" voting to our funds

a sum of £20, for which I beg to tender them our sincere thanks, and assure them that this and any further donations will be thankfully received and faithfully applied. What I would like to see would be every veterinary society in the land paying every year a fixed sum to the funds of this Society according to the number of members, and in return be represented on the Council in proportion to the amount paid, with power in their respective districts to act in all cases as if they were the Officers and Council of this Society, and render grants up to a certain amount, which might be fixed at, say £10. If a larger sum was likely to be expended they would require to bring the matter before the General Council. If some such scheme as this was adopted it would meet the requirements of the profession, and render unnecessary any other method or any other society to give temporary help, or, if you like, old age pensions, and I do hope that my successors in this office will use their best endeavours to promote the interests of the Society.

The Secretary and Treasurer will now enlighten you as to its present position.

SECRETARY'S REPORT.

Mr. President and Gentlemen,—In submitting my Annual Report I have much pleasure in recording the continued growth and success of the Society. During the year twelve new members have been enrolled, one resigned, and two have died; at the present time 240 names remain on the register. Four Council meetings have been held during the year, and four cases of defence have been presented for advice and assistance. Two of these cases have not been proceeded with, one did not come within the Council's jurisdiction, and after due consideration was dismissed, and in the fourth the defendant was advised to try and make an amicable arrangement with his client; this was carried out to the satisfaction of both parties, the cost to the Society being £30. The Council have had six applications for assistance from the Benevolent Fund, and the following sums have been granted. Mrs. F., £10; Mrs. R., £5; Mrs. W. D., £5; Mrs. F., £40; Mrs. J. L. F., 5s. per week for twelve months; and a further grant of 5s. per week for twelve months to Mrs. K. C.

I am sorry to report that only one of the above applicants had any connection with the Society. May I once more strongly advise the members of our profession to join the Society, and thus help in the good work. The annual subscription, 10s. 6d., is small indeed in comparison to the great benefits which it is able and willing to bestow upon its members, and, if necessary, to those nearest and dearest to him. The Council wish to acknowledge, with thanks, a donation of £20 from the National Veterinary Association.

The TREASURER, in presenting his Report and Balance-Sheet to date, said the accounts would be duly audited at the end of the year, and a copy of the balance-sheet forwarded to each member.

Mr. W. A. TAYLOR moved the following motion, due notice of which was given, was seconded by Mr. E. Faulkner and carried:—"That in all cases of application by members for assistance from the defence branch it shall be imperative for the applicant when requested to attend in person before the Council to state his case."

Mr. SAM. LOCKE proposed, and Mr. W. Woods seconded, "That on application being made for assistance from the Benevolent Fund, the

Secretary shall call a meeting of the Council if deemed advisable by the President, or by the Vice-President, Treasurer, and Secretary acting conjointly.—(Carried).

Mr. E. FAULKNER proposed, and Mr. J. B. Wolstenholme seconded, "That the advertisement in *The Veterinary Record re* the Society be continued for twelve months, also same be advertised in *The Veterinary Journal* and *Veterinarian* for same period. After discussion the matter was left in the hands of the Secretary to use his discretion in the matter.

The TREASURER brought forward the subject of arrears, and mentioned three members who were four years in arrear. He proposed they be written to, and intimate that if subscriptions be not paid by the end of the year their names would be crossed off the roll of membership, as per Rule II.—(Carried).

He also proposed that the Secretary be requested to write to Mr. Hunting, the Hon. Sec. of the National Veterinary Association, tendering the grateful thanks of this Society for the handsome donation of £20.

ELECTION OF OFFICERS.

The following gentlemen were appointed officers for the year 1902:—*President*—Geo. Morgan, F.R.C.V.S., Liverpool. *Vice-President*—W. A. Taylor, F.R.C.V.S., Manchester. *Treasurer*—E. Faulkner, M.R.C.V.S., Manchester. *Hon. Sec.*—Sam. Locke, M.R.C.V.S., Manchester. *Council*—J. Abson, F.R.C.V.S., Sheffield; J. S. Carter, F.R.C.V.S., Bradford; A. Lawson, M.R.C.V.S., Manchester; R. S. Reynolds, M.R.C.V.S., Liverpool; R. C. Trigger, F.R.C.V.S., Newcastle-under-Lyme; A. L. Butters, M.R.C.V.S., London; T. Hopkin, F.R.C.V.S., Manchester; A. W. Mason, F.R.C.V.S., Leeds; J. E. Scriven, M.R.C.V.S., Tadcaster; J. B. Wolstenholme, F.R.C.V.S., Manchester; W. Woods, F.R.C.V.S., Wigan; J. E. Kitchen, M.R.C.V.S., London. *Auditors*—Messrs. Butcher, Litton, Pownall, and J. B. Wolstenholme.

A vote of thanks to the officers for their services during the past year and to the Chairman closed the proceedings.

SAM. LOCKE, *Hon. Sec.*

LOUPING-ILL AND BRAXY.[1]

MR. CHARLES GRIEVE, Branxholme Park, Hawick (Teviotdale Farmers' Club), moved—"Resolve that the Board of Agriculture should take steps to investigate into the causes of these diseases, and the best means of remedying the same."

Louping-ill is a disease very prevalent on most hill farms, and especially on both sides of the Border. It is extremely arbitrary in its character. It may be very bad on one part of a farm and not on another, a dyke or a burn dividing the infected area, and there being no visible difference between the soil or pasture. The months of April and May, during the lambing season, is the time when the sheep are seized with it. The symptoms are staggering gait, loss of power in the limbs, neck twisted, as if the brain and spinal cord were paralysed. There are sometimes out-

[1] From Report of Conference of Scottish Chamber of Agriculture and Associated Societies, held in Edinburgh 9th October 1901.

breaks in the autumn, but April to June is the most fatal period. Cattle and pigs sometimes take it. In mild outbreaks only lambs die of it, but even if they recover, they are seldom of any value. It is peculiarly annoying to shepherds to see the ewes falling at this time after they have successfully brought them through a hard winter, perhaps feeding with hand for weeks and pulling them out of snow wreaths, &c. The Teviotdale Farmers' Club formed a committee some time ago to investigate and procure information from professional men regarding the cause and cure. They issued a very exhaustive report on 4th November 1880, having been at work for two years previously. The professors and veterinary surgeons, among others, consulted were Fair, Gamgie, Whalley, Law, Hamilton, Goodsir, Robertson, Brotherston, Webster, Williams, &c. Many of these had infected sheep sent them, both alive and dead, but no practical result as to cause or cure was arrived at. Since that report was issued, Messrs. Meek and Greig-Smith, of Durham College of Science, have taken up the subject, and great credit is due to them for the exhaustive experiments and reports which they have made. The conclusion they arrive at is that louping-ill is caused by ticks bred in the grass. We all admit that louping-ill and ticks are nearly always found together. Wherever there are ticks there is louping-ill, but sometimes we find louping-ill without ticks. These cases, the professors say, are not louping-ill, but anthrax. The suggestions they make for the destruction of ticks, or the means of preventing them from getting on to the sheep, are not very easily carried out. Ticks are bred in the grass in early spring, and climb up over the legs and face of the sheep when grazing on those parts where ticks abound. The professors say that the larvæ die if they do not find a suitable post in early summer, and, therefore, if they could be warded off for two or three seasons there is every reason to think they would be greatly diminished, if not quite exterminated. Their suggestions for doing this are dipping the ewes on the eve of lambing and keeping the sheep off tick-infected areas during the louping-ill season. Now, to dip sheep on the eve of lambing is considered much too dangerous; and, moreover, I am sure it would not prevent the ticks from getting on the legs and faces, for the dip is soon rubbed off those parts in going through the rough grass or heather. The other suggestion of keeping the sheep off infected pastures would require extensive fencing at great expense, and this would, in many cases, spoil the run of the sheep. The other disease which hill stock and all sheep suffer from is braxy or sickness. It is worst from November to December, and generally affects only the hoggs and young. The death-rate over the whole country is very large. I refer you to a very able address on this subject delivered by Professor Hamilton, of Aberdeen University, this day week at the opening of the session of the Royal Dick Veterinary College. He has been studying this disease for the last five years, and puts the average death-rate over the country at 15 to 20 per cent., and at Morven 40 to 50 per cent., and he himself had seen whole stocks of lambs cleared out in the West Highlands when they had been wintered at home. He also expressed his astonishment that, as far as he knew, no Government inquiry had ever been instituted to find out the cause of this disastrous loss. Questions of such importance, however, should not be left to private enterprise, and we hope ere long to see the Government give that liberal encouragement to veterinary scientific research which will lead to important results. We know how clearly M. Pasteur demonstrated by a series of experiments the

causes of splenitic fever in sheep, and with what a wise regard for the great agricultural interest the French Government gave him every facility for prosecuting his investigations. If our Government would follow the example of our Gallic neighbours when a particular disease breaks out, and would have its causes, symptoms, and the climatic and other conditions which modify or augment them, made the subject of minute and earnest investigation by the highest scientific authorities, they would confer an incalculable benefit, not only upon the farmer, who is directly interested, but on the whole country, for whatever affects the food supply of the people must be a national qnestion. (Applause.)

Mr. THORBURN of Glenmoriston (delegate, Peebles Farmers' Club).—I have very great pleasure in seconding the motion. As to the question of the evil, I think that those who know about it know that it is a matter of great importance to the flocks of the country. Pretty nearly 10 per cent. per annum of the flocks are destroyed by this illness. If you happen to buy young sheep in June at Lanark and put them on infected pastures, the chances are that you will lose many of them. It is said that the disease is not so bad in wet seasons, but it is hard that we should have to look to bad and rainy seasons for a remedy. Agriculturists have been trying to find a remedy, and eminent authorities have been trying to discover the cause of this illness. I think Professor Williams and Mr. Meek were of opinion that tick had something to do with it, but as to what the disease and its remedy are, not the smallest hint has been given. You may burn the pasture, but that cannot be done without removing the sheep from it. Much good has been done in human diseases by careful investigations, and to a large extent some of these have been mitigated, if not eradicated: and what we desire is that Government should aid the efforts of agriculculturalists in this matter by appointing scientists to investigate the disease and discover some means by which its terrible ravages can be mitigated. I have tried to put the case before you in few words, and I hope you will unanimously adopt this resolution, and ask Mr. Hanbury to give it his most careful consideration. (Applause.)

BOARD OF AGRICULTURE COMMITTEE TO INVESTIGATE CERTAIN DISEASES OF SHEEP.

THE Board of Agriculture has appointed a Committee to investigate the two diseases of sheep known as "braxy" and "louping-ill." The members of the Committee are Professor Hamilton, Aberdeen University; Mr. J. M'I. M'Call, M.B., C.M., Assistant Veterinary Officer to the Board; Mr. E. J. Wheler, agent to the Duke of Northumberland; with Mr. R. B. Greig, F.H.A.S., F.Z.S., Lecturer on Agriculture, &c. to the Durham College of Science at Newcastle-on-Tyne, as secretary and demonstrator. The mortality from the diseases in question is a cause of very great loss to the sheep-farming industry in Scotland, amounting, as it probably does, to somewhere between a quarter and half a million of money annually, or even more. The diseases have never yet been the subject of an official inquiry, and it is to the credit of the present Board of Agriculture that they have seen the necessity for moving in the matter. The Treasury has voted a large sum of money to defray expenses.

MEAT INSPECTION.

GLASGOW TOWN COUNCIL MEETING, MONDAY, DECEMBER 23, 1901.

(From *Glasgow Herald*, 24th December 1901.)

TREASURER MURRAY called attention to a report in the minutes of the Health Committee by the veterinary surgeon on an investigation undertaken by him to determine the prevalence of the *Trichina spiralis* in home and foreign pork, and the influence of this parasite on public health. He wished to know whether the veterinary surgeon made the report at the request of the Health Committee, and, if not, whether he was acting in co-operation with the Medical Officer of Health.

Mr. BRECHIN said that he had no recollection of the consent of the Committee being given for this inquiry.

Treasurer MURRAY said he had the report in his hand, and it seemed to deal almost entirely with the effect of *Trichina spiralis* on the health of the community. He wished to know whether it was the veterinary surgeon who was to advise the Corporation on matters relating to the health of the community, or whether it should be the Medical Officer of Health.

Mr. SCOTT complained that the lay members of the Corporation simply said amen to any absurd proposition that was brought forward by any professional gentleman. A big veterinary department was being built up against the wishes of the Committee. When Dr. Chalmers rushed into the Health Committee and launched his bubonic plague, everybody seemed to swallow what the Medical Officer said.—("Question.") There was no question about it. He (Mr. Scott) happened to have the courage to oppose the proposition of the plague being among us, and it vanished into thin air.—(Laughter.) That was bogey No. 1.—(Laughter.) Then the bacteriologist showed the importance of his department, and seemed to induce the whole Committee to give him another assistant, who was not required, and whose appointment he (Mr. Scott) opposed. He thought that the lay members of committees should use their common sense in the ordinary way. The Committee at once took the scare in regard to this *Trichina spiralis* on the report of the veterinary surgeon, and yet Dr. Chalmers, when they asked him, said he never heard of it among our population at all. He took it that the Health Committee employed the veterinary surgeon to inspect meat, not to go about building up great theories to scare people. Officials should take their instructions from the committees.

The LORD PROVOST said both Treasurer Murray and Mr. Scott were out of order, because, though the matter was in the minutes, it was not open for discussion. He suggested that the discussion should be delayed until the report was submitted.

This was agreed to, and the minute was approved.

DISPOSITION OF DEAD ANIMALS IN FOREIGN CITIES.[1]

INQUIRIES at the Bureau of Animal Industry for America manifest a considerable interest in the disposition of the bodies of dead animals, especially in foreign cities. The information given under this head was kindly furnished through the Department of State. It shows that many points are taken into consideration in the disposal of the bodies of animals, such, for instance, as the use of the flesh for cat and dog meat, the fat for soap making, the hoofs for glue making, the bones for fertiliser, the hides for leather, &c., or, in case the animal died of a contagious disease, its complete incineration. The sanitary phase of the question is of more importance, of course, than the economical. Neither of these conditions is neglected in the cities of the United States, and our people will probably be interested most in those parts of the accompanying reports which treat of the methods employed to dispose of the carcase.

LONDON.

(Hon. William M. Osborne, Consul-General at London, furnishes the following report.)

Horses that die in the streets of London are removed, and those that are incapacitated for work are removed and slaughtered by persons specially licensed according to Act of Parliament. One firm in particular has several depôts conveniently located in the different districts in and about London. At these depôts carts are kept clean and always in readiness to attend at a moment's notice to any call for a dead or injured horse.

All live horses taken to the slaughterer must be killed within three days, but all animals must be kept the full three days and their appearance in no way interfered with—this in case a horse so received should be stolen. The live horses are pole-axed. The hides are sold to be made into leather, mostly for cavalry trousers, carriage tops, boots, whiplashes, &c. The meat is removed from the bones, placed in large kettles, and cooked for cat meat, and the tripe is used for dog food. A fair-sized horse will average 390 pounds of meat. The bones are placed into a digester to remove the oil. The yield is about 25 pounds to 100 of bones. This oil is used by the candlemakers for lubricating purposes and also for leather dressing. After the oil is extracted the bones are ground and manufactured into fertiliser. The hoofs go to the glue makers and the bones of the feet to the button makors. The old shoes go to the blacksmith to be remade and used again. The hair from the mane and tail is made into covering for sofas and chairs, fishing lines, &c.

It is estimated that there are annually 30,000 dead and useless horses disposed of in this way in London, 28,000 of which are handled by one firm. This firm has every appliance and convenience necessary for properly conducting this bureau, even to smoke and fume destroyers, which prevent any smoke or odour escaping to the outside. They have also refrigerating chambers that will accommodate 300 carcases. The establishment is open and at work night and day. The price of a dead horse or of one that is useless and sent to the slaughter is from $5 to $7.50, according to size and condition. The amount is decided and paid by the slaughterer.

[1] From U.S. Department of Agriculture's Sixteenth Annual Report of the Bureau of Animal Industry for the year 1899.

By Act of Parliament, veterinarians are appointed by the Board of Agriculture and operate in connection with the police. When a horse is injured in the streets the veterinarian is sent for, who attends with anæsthetics, &c. If, in the opinion of the veterinarian, the animal is mortally injured, or for other reasons should be slaughtered, a licensed slaughterer should be sent for, or the veterinarian himself may undertake such work. An ordinary butcher is called in if necessary. The police immediately call for a dealer in dead horses, whose cart is soon on the ground to take the carcase to one of the reducing depôts.

The fee for slaughtering an animal is 5s. ($1·20), to be paid by the owner. In case he refuses, such fee is paid out of the police fund.

In the event that the owner of a mortally injured horse refuses to kill the same or to remove the carcase at once, the police take charge of the slaughtering and removing, in which case it is optional with the owner whether or not he pays the slaughtering fee. Where the owner takes charge of the slaughtering, removing, &c.. the police do not interfere.

All dogs and cats that are found astray or dead in the streets are taken to the Home for Lost Dogs at Battersea, London. In order to explain the disposition of the dogs and cats found in the streets of the Metropolis, I cannot do better than to quote from the report of the chairman of the above institution, Sir George Samuel Measom, J.P.:—"Last year, in consequence of the muzzling order, as you have heard, we received into the Battersea Home 23,840 dogs. Of these, 19,624 were sent in by the London City Council, 2888 were taken there by the police, 77 by private persons, and 1351 were brought to be destroyed. Out of the 23,840 received at the Home 19,650 were painlessly put to death in our lethal chamber, 2150 were sold, while 2044 were restored to their owners; and I have no hesitation in saying that double or treble this number would be restored were owners to show a little more energy in their efforts to recover their lost companions. Last year we also took into the home 240 boarder cats and 380 strays. No less than 29 tons of biscuit, 69 tons of meat, 392 gallons of milk, and a quantity of fish, especially for the cats, formed the total of the provisions consumed during the twelve months.

All dogs and cats that are found dead in the streets or that are killed at the Home are cremated.

DUBLIN.

(From Hon. Joshua Wilbour, Consul at Dublin, Ireland,)

In Dublin carcases found lying in the streets or roadways are regarded as nuisances, and are removed to the cleansing department, and buried or otherwise disposed of. If the carcases are diseased they are put in a destructor and subjected to a high temperature of steam and boiled down. This work is done by a knacker who has a contract with the city government for the removal and destruction of dead animals found in the streets. When a dead animal is found in private property, the owner must remove it. If the bodies are healthy and fit for food, they are sold by the knacker as cat meat in London and elsewhere. If unfit for food, they are, after being boiled down, made into fertiliser by the addition of acids. In the country diseased animal bodies must be buried by the Local Authorities, under not less than 6 feet of earth, with a layer of at least 1 foot of lime both above and beneath the carcase.

The following is an extract from "The Anthrax Order of 1899," issued by the Lord-Lieutenant and Privy Council in Ireland:—

"*Disposal of Anthrax Carcases.*

"The carcase of a diseased or suspected animal shall be disposed of by the Local Authority as follows:—(*a*) Either the Local Authority shall cause the carcase to be buried as soon as possible in its skin in some convenient or suitable place to which animals shall not have access, and which is removed from any dwelling-house, and at such a distance from any well or water-course as will preclude any risk of the contamination of the water therein, the carcase being buried at a depth of not less than 6 feet below the surface of the earth, and with a layer of lime not less than 1 foot deep both beneath and above it. (*b*) Or the Local Authority may, if authorised by licence of the Lord-Lieutenant, cause the carcase to be destroyed by exposure to a high temperature or by chemical agents, and for that purpose to be taken in charge of an officer of the Local Authority, to a horse slaughterer's or knacker's yard or other place approved for the purpose by the Lord-Lieutenant.

"A carcase of a diseased or suspected animal shall not be buried or destroyed otherwise than by the Local Authority, or be removed from the farm or premises upon which the animal died or was slaughtered except for the purpose of being buried or destroyed by the Local Authority.

"Before a carcase is removed for burial or destruction under this article, all the natural openings thereof shall be effectually plugged with tow or some suitable material saturated in a strong solution of carbolic acid or other suitable disinfectant. In no case shall the skin of the carcase be cut, nor shall anything be done to cause the effusion of blood except by or under the supervision of a veterinary inspector, and so far as may be necessary for the purpose of microscopical examination.

"A Local Authority may cause or allow a carcase to be taken into the district of another Local Authority to be buried or destroyed with the previous consent of that Local Authority, but not otherwise."

PARIS.

(From Hon. John K. Gowdy, Consul-General at Paris, France.)

The carcases of animals found floating in the Rivers Seine and Marne, the Canals of St. Maurice and St. Maur, including the waters of the Department of the Seine, are disposed of by a contractor, who is subsidised by the administration. As to carcases of animals dead or dying in the public street, their owners have the right to employ any one they choose to carry them away and to make such arrangements as may be possible as to the conditions and expense pertaining thereto.

In urgent cases, and where the dead animal has been abandoned, the police officers, who are supplied with a list of horse slaughterers, notify one of the slaughtering firms by telephone or otherwise to remove the carcases. None of the Parisian horse slaughterers has an exclusive right to the business. Important firms and large companies make a contract for one or more years with a horse slaughterer of their choice. The carcases are disposed of in the horse slaughter-house inclosures, which are daily inspected by veterinarians attached to the Prefecture of Police.

The proprietor of the slaughter-house reserves the lungs and the hides of each horse killed or brought in dead, to be placed for inspection before the veterinarian for his decision as to the existence or non-existence of any contagious or other diseases. The owner of the carcase must deliver at

the slaughter-house the entire carcase, no portion lacking, to avoid the possibility of diseased meat being employed in any way.

Special records are kept of these slaughter-houses, in which appear the deliveries of carcases, with the names of the owners of same. This particular service is under the supervision of the Prefect of Police. When an immediate removal of a carcase is made by order of the police, the value of the product of the carcase goes to the owner of the same, he, however, having to defray the expenses pertaining to the operation.

There are at present in Paris three firms in the horse-slaughter business. Men employed in this occupation earn from 5 francs (96 cents) to 6 francs ($1.15) per day, exclusive of pourboires (tips). Dead horses are removed in waggons or carts called corbeillards. Disabled or wounded horses are removed in low-hanging covered carts called monte à regret (enter with regret). The two models of carts are provided with levers and pulleys for handling the carcases and are thoroughly washed and disinfected every day.

BERLIN.

(From Hon. Frank W. Mason, Consul-General at Berlin, Germany.)

The carcases of horses, condemned cattle, and other animals from the abattoirs, and of dogs killed at the city pound, are disposed of under a system based on a contract which will be hereinafter described, and by a process or apparatus invented and patented by Mr. Rudolph A. Hartmann, of Berlin. The same system and similar apparatus are employed at Konigsberg, Breslau, Emden, Mayence, Bonn, Schweidnitz, and Stett, as well as at Caracas, Venezuela, and may be said to represent the latest and most advanced application of German science in that direction.

The plant used for this purpose in Berlin has been recently set up on land belonging to the police department in a remote north-eastern quarter of the city. These premises have been leased for ten years to the highest bidder, namely, the contractor who has undertaken by agreement for that period (1) to gather up and dispose of all domestic animals which are killed by accident or die within city limits; (2) to accept and dispose of all condemned animals and parts of carcases of condemned meats from the municipal abattoirs; (3) to keep in service a prescribed number of waggons for the removal of wounded animals from the street, which must be done within a fixed time after notification in each case by the police. For the dead or fatally wounded horses the contractor pays to the owner of the animal from 10 to 30 marks ($2.38 to $7.28), according to agreement, and acquires thereby full title to the carcase. For the condemned animals and meats from the abattoirs he must pay prices agreed upon between himself and the vieh versicherungs gesellschaft (cattle insurance company), an organisation which for a certain premium insures the animals of farmers and drovers against the chance of condemnation by the veterinary officers at the abattoirs, who inspect rigidly every animal before it is admitted to slaughter. The animal so insured and condemned becomes the property of the insurance company, which sells it to the contractor, as above stated, and at a price mutually agreed upon, and which depends naturally upon the species and size of the animal, its condition as to fat, and the disease by reason of which it was condemned. An animal dying of anthrax, for instance, is worth nothing, but comes gratis to the contractor and must be destroyed. None of its fat, hide, or tissue of any kind can be used, except

its ashes for manure. With this exception, which is ordained as a natural measure against the spread of contagious diseases, all dead and condemned animals which come into possession of the contractor are worked up by the apparatus of Mr. Hartmann, and yield, besides skins, three products, namely, fat, used for soap making, axle grease, &c., glue, and animal fertilisers; and out of these the contractor derives the revenue which recoups his outlay, and yields, theoretically at least, a moderate profit.

Besides condemned animals and meats from the abattoirs and the stray dogs which are caught and killed by the police, the plant at Berlin disposes of about fifteen horses per day. These, as well as the other animals, are first skinned. The carcases are then cut up by hand and placed with the viscera in one of the perforated trays, of which three are arranged to slide into each of the large iron cylinders which form the principal feature of the apparatus. The trays being filled and in position, the cylinder head is closed and firmly secured, and steam heated to a pressure of four atmospheres (58.8 pounds) is turned into the jacket covering of the cylinder and maintained for twelve hours, it being a fundamental principle of this system that the heat is applied indirectly and dry, the moist steam never coming in contact with the animal matter. The cylinders are hermetically closed, so that no offensive odours escape, and the whole establishment, although naturally rank and unsavoury, is thought to reduce to a minimum the repulsive features of the process.

The economic management of this institution being in private hands, its statistics do not form a part of the public municipal report, but it has been ascertained that the dead horses received there average about three hundred per month, and that during the year from April 1, 1896, to March 31, 1897, there were delivered from the abattoirs 1337 condemned cattle, 1488 hogs, 526 calves, and 265 sheep—in all 3616 animals, besides portions of carcases that had been rejected by the meat inspectors.

The advantages claimed for the apparatus with which this work is done are that it utilises every valuable portion of the animal and that it extracts the fat so successfully that only 10 to 12 per cent. of the oleaginous matter remains in the phosphate residue that is used as fertilising material. The apparatus is, according to the statement of the inventor, so constructed as to apply two new principles to the reduction of animal matter to its elements (gelatin, fat, and nitrogenous waste): First, the steam heat is so applied as to cook and reduce the flesh in its own juices, thus avoiding wasteful dilution with water; second, the condensed water is used directly over and over again with very small loss in temperature and consequent economy of fuel; third, the condensation of the gelatinous vapour in a separate closed reservoir without contact with cold water.

(*To be continued.*)

Extracts.

RUPTURE OF THE DIAPHRAGM FOLLOWING ON A PERMANENT ABNORMAL DILATATION OF THE STOMACH.

At a meeting of the *Société Centrale* M. Brun exhibited the lower jawbone of a mare bought the previous year in an apparently excellent state of

health, and aged about five years, which had died a few weeks previously from the consequence of rupture of the diaphragm following on a permanent abnormal dilatation of the stomach. This mare, during the year that it was possible to watch her, appeared to be quite well, but it was always noticeable that she retained in her mouth appreciable quantities of unmasticated food. Even some two or three months after the purchase, M. Brun had had occasion to notice this peculiarity, and had had the teeth levelled. That was in August last year; in the month of September M. Brun examined the animal's mouth, and found that there appeared to be nothing abnormal in the disposition of the teeth or the cheeks, and could see nothing better to do than to complete the first operation, which had produced no result.

In November he learned that the mare, while working regularly, always chewed her food badly, and decided to make a third examination of the buccal cavity, but in doing so to make certain that the lesion, if there was one, should not escape notice. For this purpose he used an electric lamp, sufficiently strong and handy; he was then able to examine the teeth, the interior face of the cheeks, the attachments of the tongue, the pharynx, and the palatine vault; but there was nothing to warn him that one or other of these places was particularly in danger.

During the winter the animal was subjected to a special food treatment, but M. Brun lost sight of it just at the time (the end of June of this year) when it was taken with severe colic, to which it was not long in succumbing. At the autopsy, after having observed the lesions spoken of above, he removed the lower jaw, the better to take note of the condition of the organs of the mouth. With regard to the upper jaw, there was nothing abnormal but a curvature, more accented at the back, of the plane of the whole of the friction-surfaces of each of the molars. There was nothing in the palatine vault, no teeth displaced,—the molar rows appearing in good condition.

The lower jaw, on the other hand, showed the following peculiarities:—The three first molars on each side were almost intact, but very much soiled with food which washing did not remove; the fourth molar on each side was separated from its neighbour, both back and front, by a space which would have held a good-sized penholder, this space being filled with decomposed food, become hard, and making a sort of padding (felting) difficult to extract. There was there, in the general line of the teeth, a very clear separation, a regular gap, which was bordered at the back by the fifth molar, itself slightly buried, and further on the sixth, which was not of proper height either. M. Brun's first impression was that these three teeth, or at least the fourth, must be very much injured, and rotten either in the extra-alveolar part or in the root. Therefore his astonishment was great when, later on, after having stripped off the soft parts, he found no trace of disease in the teeth; they had sunk into the alveola, had sustained a quite appreciable change of direction, but had remained sound throughout their entire length. It was the table of the bone on the contrary which had sustained a certain injury which had rendered it less resisting, more friable, and thinner. The lesion was bilateral, and it was noticeable that at the level of the fifth and sixth molars the thinness became accentuated till it reached its maximum at the rising branches of the maxillary, where the thickness is reduced to that of a thin piece of cardboard. M. Brun was unable to say what the nature of this injury is. The observation is

very incomplete, but it proves once again the importance of good mastication for the proper performance by the digestive organs of their functions. Evidently, in the case of this mare, the formidable lesions discovered in the stomach would have had plenty of chances of not being produced if the food had been better prepared by the teeth.

In the discussion which followed, M. Lavalard said it would have been interesting to see the upper jaw in order to observe the difference between the two. He suggested tuberculosis of the jaw. M. Cagny thought it might be a case of osteitis. M. Almy suggested osteomalacia or osteoporosis.

(*Rec. de Méd. Vét.*, 30th August 1901.)

EXPERIMENTS IN TELEGONY.

A RED Tamworth sow was served for the first time by a boar of the same breed; she gave birth to a litter of red pigs at the Brussels Exhibition, where this little family, so extraordinarily coloured for pigs, became the centre of attraction. Some months later, for want of a boar of her own race, we had this same mahogany red sow, of pure Tamworth breed, covered by a boar of the white Yorkshire stock, also quite pure, that we had at our disposal. The final result was the birth of twelve magnificent pigs, very vigorous, and as white as snow, like their father. At the outside a few of these young pigs showed here and there a few red marks, particularly at the ears; these were largely effaced by time.

The mother, with a long head, and of the colour of an Irish setter, gave birth to and brought up, as a result of this "irregular marriage," twelve pigs as white as their father, with shortish head and mostly of the male sex, so great is the hereditary power of the aforesaid Yorkshire boar.

But observe the consequence. The sow was again in heat. This time we used a Tamworth boar. From the latter she conceived ten red pigs, and of the Tamworth type, like the father and mother, the latter not having been in any way telegonated in spite of the extreme hereditary power of the white boar, which seemed to have impregnated her so thoroughly with his seminal fluid the previous time.

Here we have an experiment which has the value of a very striking proof against telegony (which we do not admit). Breeders of any kind of animal whatever need take no heed of this theory.

(Professor Ad. Reul, *Ann. de Méd. Vétér.*, Nov. 1901.)

MELANOSIS IN THE OX.

OUR colleague, M. Gallier, has been enabled to observe in a Norman ox, three years old, in good condition, a melanotic tumour occupying the right parotidian region. At the autopsy of this animal, slaughtered for the butcher, a tumour was detached weighing nearly 23 lbs. This voluminous tumour had probably developed while the animal was very young, for it had deformed and pushed back the right branch of the inferior maxilla.

If melanotic tumours are infrequent in the bovine species, still one

cannot, as M. Moussu remarks, consider bovine melanosis as an exceptional fact. Cases have often been noticed of generalised melanosis in sheep, nay more, even isolated and voluminous melanotic tumours. This melanosis has even occurred in animals which do not have white coats.

(*Bulletin de la Société Centrale.*)

CONTRIBUTION TO THE TREATMENT OF HÆMOGLOBINURIA IN THE HORSE.

BY M. KAS.

THE author calls the attention of practitioners to the good results which he has obtained in the treatment of this affection by the use of bromide of potassium; out of sixteen infected subjects that were treated with this agent, fifteen recovered. After having made his diagnosis of hæmoglobinuria, he administers a solution of bromide of potassium in about 16 oz. of distilled water, and immediately after he bleeds the animal at the jugular. This done, he injects under the skin 10 centigrammes of sulphate of eserine in 5 grammes of water. After having applied friction to the animal by a stimulating liniment, or simply by camphor and alcohol, he covers the hind-quarter with cold compresses, which again are covered by linen wrappings. When the animal shows the phenomena of paralysis of the bladder or the intestine, he passes a catheter, and performs back-raking. In serious cases he administers a second dose of bromide the next day. He recommends never slinging a horse before the third day.

(*Thierärztlichles Centralblatt.*)

TREATMENT OF TRAUMATIC ARTHRITIS OF THE HOCK JOINT BY ANTISEPTIC DRESSINGS AND ANTISTREPTOCOCCIC SERUM.

BY M. PÈCUS.

THE gravity of wounds of the hock joint is not only on account of its complicated anatomy, but also from its extensive motion, which renders the application of an antiseptic bandage very difficult, so that it is liable to infection. After many unsuccessful trials, the author claims to have hit off a method by which he can apply a permanent bandage, by means of which he is able to carry out proper antiseptic treatment. He also uses subcutaneous injections of antistreptococcic serum with the object of preventing the invasion of the wounded articulation by the *Streptococcus pyogenus*. The wound and the surrounding skin is carefully disinfected before the bandage is applied and a drainage tube adjusted before the dressing is put on. The permanency of the bandage, which extends from the middle of the thigh to the fetlock, depends on leaving the point of the hock free. This is included in a separate disarticulated bandage, kept in its place by tapes tied on the anterior part of the hock, the primary bandage passing over it. To prevent the whole slipping, M. Pècus advises the advisability of putting a band or rubber ring on the limb below the fetlock joint.

The bandage, if all goes well, need not be removed for eight or twelve days, even if the animal is left loose in a box. The temperature of the patient and the way in which he puts his weight on the limb will indicate the necessity of renewing the dressing. The author quotes four cases of open hock joint from kicks that he has treated. In two there was excessive suppuration, the others were not contaminated. All were successful.

The antistreptococcic serum was used as soon as possible after the accident.

(*Journal de Médecine Vétérinaire et de Zootechnie.*)

JOSHUA A. NUNN,
Vety. Lt. Colonel.

March 1901.

ULCERATIVE STOMATITIS IN LAMBS AND GOATS.

BY M. CHARLES BESNOIT.

THIS disease is very common in France, but its etiology is obscure, and the clinical descriptions given of it are very incomplete. M. Besnoit has made a new and very careful series of observations on the subject. It is a specific and contagious disease, very common in lambs, not so in goats. Young animals of this species are liable to it, and the younger the subject the more serious is the attack.

It manifests itself in three forms—

1. *Acute.*—Very contagious, and causes great losses. It is characterised by redness of the buccal mucous membrane and the appearance of white or grey patches caused by supra-mucus exudate in the form of thin membrane or film. These patches coalesce, and end by covering the whole of the buccal membrane. At the same time the films thicken, become soft and cheesy, and fall off, leaving granular ulceration of variable shapes and sizes, which prevent the animal sucking or swallowing. They remain dull and lose condition, with saliva escaping from the mouth. Many die from inanition or from gastro-intestinal and pulmonary complications.

A fatal termination is not invariable, a certain percentage recovering in from twelve to fifteen days.

2. *Virulent.*—This form is characterised by the extreme rapidity of its evolution and its gravity. It attacks very young subjects, and is always complicated by pulmonary or gastro-intestinal complications that are generally fatal. The few that do recover remain for a long time emaciated and in bad condition.
3. *Subacute.*—This form is very slightly contagious in the same flock, only a small percentage will be attacked at long intervals. The buccal lesions are not extensive, and rapidly cicatrise. It is the most common form seen in France.

The disease has been attributed to a variety of causes, but the bacteriological researches of the author have clearly pointed out that it is due to a specific organism. The specific agent causing ulcerative stomatitis in lambs and goats, which is known popularly as "Muguet," is a large micrococcus which is abundant in the softened exudate of the buccal membrane, and is also present in the visceral lesions, resulting from auto-intoxi-

cation, and which readily takes Gram's stain. It is found singly or in short chains of two to four cocci. It grows in bouillon, forming a deposit at the bottom of the tube, on gelatine or agar-agar in small colonies, and on potatoes in a cheesy mass. The rabbit is immune to it, but it is pathogenic to the guinea-pig. The following facts show its specific nature—

1. Inoculated on to the buccal membrane of lambs and kids, a pure culture caused local lesions of the same nature as the naturally acquired disease.

2. In the cheesy exudate of both the natural, and artificially produced disease it was abundant, sometimes being nearly a pure cultivation.

3. In the vesicles round the lips of experimental subjects it was found in nearly a pure condition.

4. It was found in the visceral lesions from auto-infection in animals that had died from naturally acquired disease.

Rigid prophylactic measures alone will prevent its spread. The disease should be attended to as soon as possible so as to arrest the evolution of the buccal lesions and prevent intestinal auto-infection.

With this object chlorate of potash gargles 5 per cent. are indicated. Also boracic acid mouth washes and the ulcers dressed with nitrate of silver or tincture of iodine. If there are only a small number of lambs attacked, and it can be managed, the ewe can be milked and the lamb better fed.

(*Revue Vétérinaire.*)

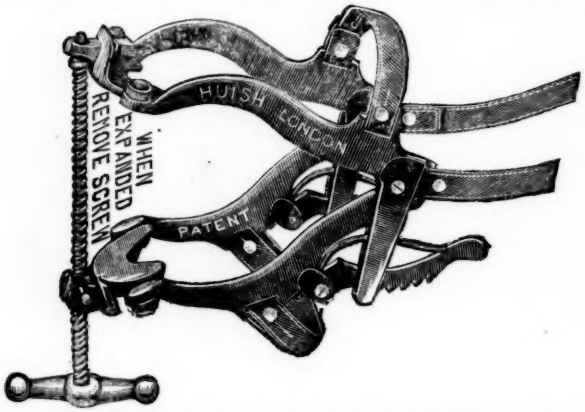
April and May 1901.

JOSHUA A. NUNN,
Vety. Lt. Colonel.

Reviews.

HUISH IMPROVED MOUTH GAG.

THE best mouth gag we have ever used is the *Improved Patent Revela-*



tion, patented and manufactured by C. H. Huish, London. The fault of the older one was that in some cases there was difficulty in opening the

mouth, and even when that was overcome, and before the rack acted, there was a danger of it slipping and injuring the surgeon's fingers, which we know to our own cost. With the improved gag, however, both the difficulty and the danger are done away with, as the mouth is opened by means of the screw. We have much pleasure in strongly recommending this gag to our readers.

THE LIVE STOCK JOURNAL ALMANAC for 1902 contains a large number of special articles and many illustrations, in addition to the breeders' tables, lists of societies, fares, statistics, &c., well-known features of this popular book of reference, which has become almost indispenable to the rapidly increasing constituency of breeders of live stock throughout the world. This year the articles number forty-five. The frontispiece is a reproduction of the painting by Benjamin Marshall, representing the hackney horse of a hundred years ago, and there is a brief article dealing with the origin and early characteristics of the breed. Sir Walter Gilbey contributes an important study on the subject of "Size "in Horses" in which he traces the gradual increase in height from the sixteenth century to the present day, diagrams being given to indicate the increase of the thoroughbred from 14 hands in 1700 to 15 hands 2½ inches in 1900. The question of height and utility is discussed and many useful hints are thrown out. Under the heading "Shire Horse Breeding as an Industry for Farmers," several leading authorities, including Mr. P. A. Muntz, M.P., Mr. Sutton Nelthorpe, Mr. Walter Crosland, Mr. Edward Green, and Mr. A. W. Richman give their views on a most important branch of stock breeding, and it is satisfactory to find that the general opinion is that the prospects for the breed are most encouraging. *Professor Wortley Axe supplies good advice on "Some Habits and Vices of Horses," and in his article he opens up the long-vexed question as to what really is* crib-biting and wind-sucking. *We should like some day soon to hear a definition of these most important vices.* Sir Richard D. Green Price treats of "The Influence of Royal Patronage on Agriculture," and alludes to the personal interest which His Majesty the King has manifested in the industry. Mr. J. S. Smith makes a plea for "Irish Hunters," and Mr Vero Shaw describes the "Saleable Horse." Notices of the various breeds of horses follow the writers, including Mr. C. B. Pitman, Mr. Wm. Scarth Dixon, Mr. Henry F. Euren, Mr. John Hill, Mr. W. C. A. Blew, Mr. A. C. Beck, Mr. Wm. King and Mr. R. M'Intyre. The paper on Shire Horses states that the average price realised at public sales in 1901 has been £112 per head, as compared with £109 in 1900. Mr. Robert Bruce discusses the importance of maintaining calf-flesh in young cattle, and Professor Sheldon has a very good article on "Cows and their Milk," in which he refers to the new milk standard and the controversy regarding tuberculosis. The papers on Breeds of Cattle commence with a comprehensive one by Mr. John Thornton on Shorthorns. There are many suggestive notes on the various other breeds of cattle in the articles from the pens of the Rev. Dr Gillespie, Mr. H. Euren, Mr. Hordern, Mr. R. Henderson, Mr. T. H. Weetman, Mr. James Cameron, Mr. G. E. Collins, Mr. E. G. F. Walker and others. Sheep are similarly treated by Mr. E. Prentice, Mr. A. Mansell, Mr. Bruce, Mr. J. O. Trotter, Mr. Jones M. Webb, Mr. W. A. Brown, &c. There is a paper on "Pigs in 1901." Mr. F. Gresham writes

on "Spaniels at Work," while Mr. C. Stein and Mr. E. Brown contribute articles on Poultry. The Breeders' Directory and the section entitled "Studs, Herds, and Flocks Illustrated" add to the value of the book for purpose of reference. The price remains one shilling. Messrs Vinton & Co., Ltd., 9 New Bridge Street, London, E.C., are the publishers.

Notes and News.

HIGHLAND AND AGRICULTURAL SOCIETY.

At a meeting of the Directors of the Highland and Agricultura Society held in Edinburgh, it was decided to take no action in regard to a communication from the Council of the National Veterinary Association forwarding two resolutions—the first suggesting that horses exhibited at agricultural shows should be submitted to a veterinary examination, and the second suggesting that "stringhalt" and "shivering" should be included in the list of diseases which disqualified breeding animals for prizes. The Reverend Dr. Gillespie suggested in this connection that it might perhaps be more to the purpose if the veterinary surgeons would agree among themselves as to what was unsoundness. It was agreed to support the Agricultural Committee of Aberdeen University in carrying out experiments, "with the object of testing the soundness of Koch's recent statement to the effect that tuberculosis in bovine animals cannot be transmitted to man."

TESTING KOCH'S RECENT STATEMENT.

At a meeting of Highland Society Directors last week it was unanimously agreed that a sum of £50 be made over to the Agricultnral Committee of the Aberdeen University for the purpose of "carrying out experiments with the object of testing the soundness of Koch's recent statement to the effect that tuberculosis in bovine animals cannot be transmitted to man." This was the object of the investigation, as stated on the Agenda. It may well be asked whether the Agricultural Committee of the Aberdeen University are to carry on experiments in the way of transmitting tuberculosis from the bovine subject to the human subject? Are the Aberdeen experimenters to feed themselves on tuberculous milk, or are they to inoculate themselves with bacilli from tuberculous cows? Or has Mr. Pottie, of Paisley, renewed the valorous offer which he made at the meeting of the National Veterinary Association by offering himself as the subject of experiment to prove that bovine tuberculosis cannot be transmitted to man? It is impossible to believe that the Aberdeen experimenters contemplate any such experiments upon themselves, or upon any other human beings. The probable explanation of the matter is that, if the secretary of the Society, in drawing up the Agenda, had shown as much 'cuteness as he showed in taking steps to prevent Dr. Gillespie from entering for the Menzies wool prize at Aberdeen with the "first prize fleece" which the Doctor bought this year, the object of the experiments would have been stated in a very different way.

(*North British Agriculturist*, 13th November 1901.)

VETERINARY INSPECTION AT SHOWS.

THE Council of the Clydesdale Horse Society are to be called upon at their next meeting to consider the question of the veterinary inspection of horses at Shows. At their meeting last week, the directors of the Highland Society were invited to consider the same question, but they gave it short shrift. The Reverend Dr. Gillespie brushed the matter aside by saying that, if veterinary inspectors would agree more among themselves as to what was unsoundness, there would be more reason in it. This view of the question commended itself so strongly to the minds of the Reverend Doctor's fellow-directors that they wasted no more words upon it, and not a single member had a word to say in favour of ensuring that the horses winning the prizes at the National Society's Shows should be certified as free from hereditary unsoundness. Some caustic critics are not hesitating to say, however, that the Reverend Doctor was very unfortunate in his argument to the effect that, "if veterinary surgeons would agree more among themselves as to what was unsoundness, there would be more reason in it." How would the Reverend Doctor care for the same argument being applied to the gentlemen of his own profession to the effect that when theological doctors, as well as horse doctors, agreed more among themselves as to what was sound and what was unsound it would be time enough to give any heed to their *dicta*. When that time of agreement comes, there will be no occasion for such outrages as have lately taken place in Scotland where the burning of stackyards and the smashing of church windows have been deliberately carried out by way of emphasising the want of agreement among the gentlemen of Dr. Gillespie's profession.

(*North British Agriculturist*, 13th November 1901.)

FROM "THE TIMES" OF 1801.

Friday, December 18.

Captain Williams, who formerly lived at Canterbury, had a large *cock* mackaw many years in his possession, which, as an extraordinary phenomenon, laid several eggs.

It is worthy of observation that two cuckows are never seen together, and there is much reason to believe it is an hermaphrodite bird. It is certain that it never builds a nest or attends its young, but leaves the propagation, or rather education, of its species to the hedge-sparrow or some other small bird. The young cuckow has a fascinating power not much known; but a correspondent had a young thrush and a young cuckow once together in the same cage, and as soon as the thrush could feed itself it constantly fed the cuckow, and starved itself to death.

INDIAN CIVIL VETERINARY DEPARTMENT.

The Secretary of State for India has appointed the following gentlemen to the Indian Civil Veterinary Department:—Professor S. Stockman, Mr. T. Rennie, Mr. E. W. Oliver, Mr. R. Hewlett.

THE RUSSIAN STUDENTS.

ST. PETERSBURG, *Dec.* 17.

An order of the Minister of Education, published in the *Official Messenger* of to-day, gives a detailed account of serious disorders which have taken place among the students of the University of Kharkoff during the past fortnight. It appears that a number of medical students, foremost among whom were several who had been expelled in 1899, but afterwards readmitted to the university, had attempted to coerce the professors into excluding from all the advantages of the university the students who in 1899 had refused to take part in the disorders. Some of the professors weakly acceded to this outrageous demand, but others resisted. Not content with their partial success in this matter, the students organised demonstrations of sympathy with the pupils of the Veterinary Institute who had recently been expelled for gross insolence to a professor. Disorderly scenes began to take place in the University and in the town on December 11, and increased in turbulence until, on December 14, it was found necessary to suspend the work of the University.

In the order published to-day, General Vannovsky expressed his deep regret that men who have enjoyed the advantages of a university training should have been guilty of such conduct. In consideration, however, of the fact that the great majority of the students have remained perfectly tranquil, he has given directions that the work of the University should be resumed. The governing body of the University is instructed to discover and to punish the students who have taken part in the recent disorders, the punishments to range in severity from a simple reprimand to temporary exclusion from the University. The professors are requested to protect by every means in their power the students who have not taken part in the disorders. The students are warned that no one who interferes with the regular work of the University will be admitted to the Government examination of 1902.

The action of the Kharkoff students is severely reprobated by the general public, even, or rather especially, in quarters where the students' movement is in general regarded with great sympathy. General Vannovsky has shown that he is animated by the desire to treat the students with every consideration, and to fulfil all their legitimate aspirations. His task is for many reasons one of very great difficulty. It is not rendered easier by events such as those which have taken place at Kharkoff. He is, however, to be congratulated on the judicious firmness he has displayed.

The *Official Messenger* also publishes an order of the Minister of the Interior placing some twenty cities and towns of Russia under the intermediate state of siege. This measure, which has been received with some astonishment, is probably explained by the fact that most, if not all, of these places are the seats of educational establishments.—(*The Times.*)

National Veterinary Association.

ANNUAL MEETING.—EDINBURGH, 1901.

PROVISIONAL COMMITTEE'S ACCOUNTS.

BALANCE-SHEET.

RECEIPTS.

Contributions to Guarantee Fund, . .	£77	18	6
50 Dinner Tickets at £1 : 1s. each, .	52	10	0
Dinner Grant from the National Veterinary Association, ...	10	0	0
14 Luncheon Tickets at 6s. each, . .	4	4	0
	£144	12	6

EXPENDITURE.

Messrs. Turnbull & Spears, . . .	£4	4	6
H. Dambmann, ...	3	15	0
Royal British Hotel, . . .	54	15	4
Messrs. Ferguson & Forrester, . .	53	14	6
Adam Cramond, Junior, . . .	12	0	0
Postage, ...	1	16	0
Refunded to Principal Williams, . .	5	0	0
Do. to Principal Dewar, . .	5	0	0
National Veterinary Benevolent and Mutual Defence Society, . . .	2	3	7
Victoria Veterinary Benevolent Fund, .	2	3	7
	£144	12	6

O. CHARNOCK BRADLEY, *Local Secretary.*

We have examined these Accounts and Vouchers and found them correct.

EDINBURGH, *December 18th*, 1901.

J. R. U. DEWAR, *President N.V.A.*
W. OWEN WILLIAMS, } *Auditors.*

ARMY VETERINARY DEPARTMENT.

WAR OFFICE, *6th December* 1901.

Imperial Yeomanry—26th Battalion.—Honorary Veterinary-Lieutenant E. Morgan to be Veterinary Officer, with the temporary rank of Veterinary-Lieutenant.

WAR OFFICE, *6th December* 1901.

Veterinary-Lieutenant-Colonel A. E. Queripel retires on retired pay.

The under-mentioned veterinary officers have been transferred to the Indian Civil Veterinary Department:—Veterinary-Major J. W. A. Morgan, Inspector-General; Veterinary-Major J. B. Mills, Veterinary-Major W. R. Hagger, Veterinary-Major R. H. Ringe, Veterinary-Major F. Raymond, F.R.C.V.S., Veterinary-Major W. D. Gunn; Veterinary-Captain F. J. Oslen, Veterinary-Captain H. M. Maxwell, F.R.C.V.S., Veterinary-Captain H. T. Pease, Veterinary-Captain G. H. Evans; Veterinary-Lieutenant A. S. T. Rydell, Veterinary-Lieutenant J. Farmer, Veterinary-Lieutenant A. Smith, Veterinary-Lieutenant F. S. H. Baldrey, Veterinary-Lieutenant G. K. Walker, Veterinary-Lieutenant J. D. E. Holmes. Veterinary-Captain R. W. Burke, F.R.C.V.S., is placed on temporary half-pay on account of ill health.

Memoranda.

Veterinary-Lieutenant-Colonel A. E. Queripel, retired pay, is granted the honorary rank of Veterinary-Colonel in recognition of his services.

Veterinary-Major J. W. A. Morgan, Inspector-General, Indian Civi Veterinary Department, is granted the temporary rank of Veterinary-Lieutenant-Colonel whilst so employed.

1st Lanarkshire.—J. F. Forrest, M.R.C.V.S., to be Veterinary-Lieutenant.

Communications, Books, Journals, &c., Received.

Agricultural Journal (Cape of Good Hope); Berliner Thierärztliche Wochenschrift; La Clinica Veterinaria (Milan); Deutsche Thierärztliche Wochenschrift; Tannoform in Veterinary Medicine (March); The Sanitary Journal; Scottish Medical and Surgical Journal; Veterinary Record; La Riforma Veterinaria; Le Mois Scientifique (Paris); L'Echo Vétérinaire (Liège); Annales de Médecine Vétérinaire (Brussels); Johns Hopkins Hospital Reports; Journal of Comparative Medicine and Veterinary Archives; Recueil de Médecine Vétérinaire; Gazette Médicale de Paris; Modern Medicine; Johns Hopkins Hospital Bulletin; Il Veterinario di Campagna (Moncalieri); Le Bulletin Vétérinaire (Orleans); Revista de Medicina Veterinaria (Bucarist); La Revista Veterinaria (Buenos Aires); Zeitschrift für Fleisch-und Milchhygiene (Berlin).